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NATIONAL DAM INSPECTION PROGRAM. PA-647 DAM (NDI ID NUMBER PA-8--ETC(U)
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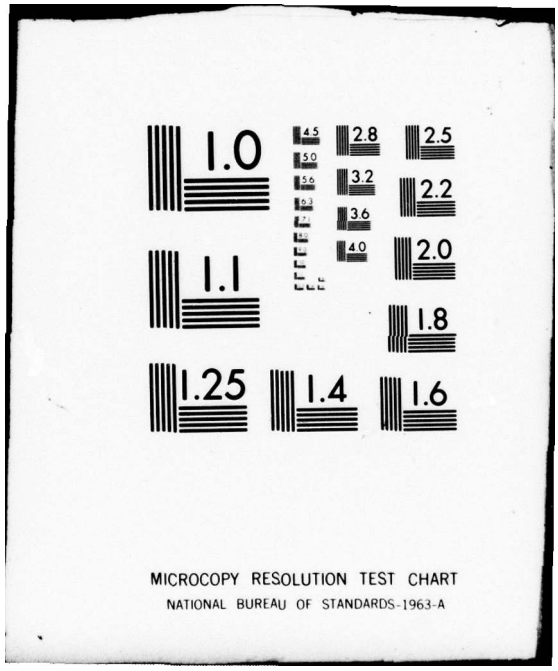
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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Department of the Army, Office of Chief of Engineers, Washington, D.C. 20314.

The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon visual observations and review of available data. Detailed investigation and analyses involving topographic mapping, subsurface investigations, material testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the inspection is intended to identify any need for such studies which should be performed by the owner.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of the dam depends on numerous and constantly changing internal and external factors which are evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The assessment of the conditions and recommendations was made by the consulting engineer in accordance with generally and currently accepted engineering principles and practices.

(6) National Dam Inspection Program. PA-647 Dam (NDI ID Number PA-821, DER ID Number 63-76), Ohio River Basin, Robinson Fork, Washington County, Pennsylvania. Phase I Inspection Report.

[CONT'D FROM P. 1]

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

(11) May '79

NAME OF DAM: PA-647
STATE LOCATED: Pennsylvania
COUNTY LOCATED: Washington
STREAM: Robinson Fork, a tributary of Wheeling Creek
DATE OF INSPECTION: December 8 and 21, 1978

(12) 80 p.

ASSESSMENT: Based on the evaluation of the conditions as they existed on the dates of inspection and as revealed by visual observations, the condition of PA-647 dam is considered to be good.

A wet area was observed on the downstream slope below the berm elevation near the left abutment. This area should be periodically observed and remedial work performed if conditions change.

The spillway capacity is classified to be adequate according to the recommended criteria.

It is recommended that a formal warning system be developed to alert the downstream residents in the event of emergencies.

It is recommended that the following action be implemented on a continuing basis:

1. The wet area located on the downstream slope should be periodically observed. Necessary remedial work should be performed if the extent of the wet area increases or sloughing and seepage develops.

2. Around-the-clock surveillance should be provided during unusually heavy runoff and a formal warning system should be developed to alert downstream residents in the event of emergencies.

(15) DACW31-79-C-0014

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3. The dam and appurtenant structures should be inspected regularly and necessary maintenance performed.

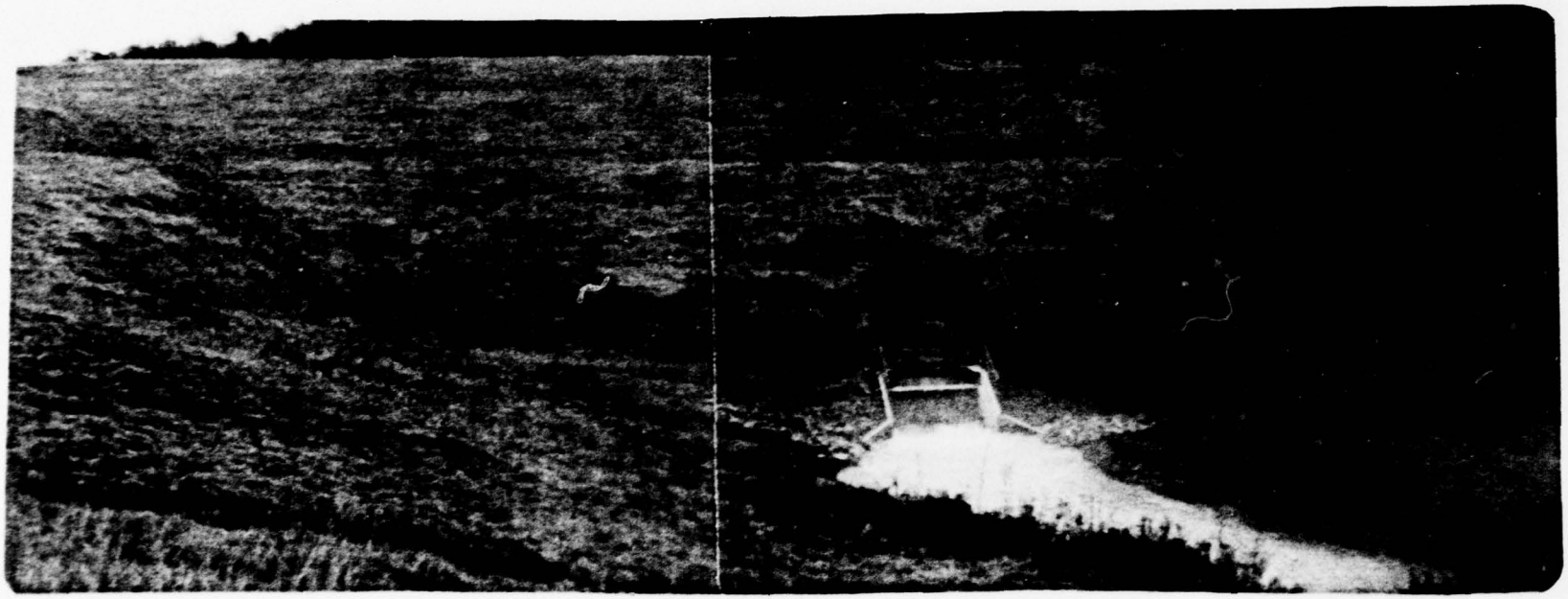
Lawrence D. Andersen

Lawrence D. Andersen, P.E.
Vice President

G. K. Withers

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer

DATE: 22 Apr 79



PA-647 DAM
NDI I.D. NO. PA-821
DECEMBER 8, 1978

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(Continued)

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM
PA-647 DAM
NDI I.D. NO. PA-821
DER I.D. NO. 63-76

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. The inspection was performed pursuant to the authority granted by The National Dam Inspection Act, Public Law 92-367, to the Secretary of the Army, through the Corps of Engineers, to conduct inspections of dams throughout the United States.

b. Purpose. The purpose of this inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project

a. Dam and Appurtenances. The PA-647 dam is one of the seven flood control structures in the Wheeling Creek watershed. The dam consists of an earth embankment approximately 500 feet long with a maximum height of 95 feet from the downstream toe and a crest width of 15 feet. The flood discharge facilities for the dam consist of a drop inlet type primary spillway located near the left abutment (looking downstream) and an emergency spillway on the right abutment. [CONT'D ON P. 1-3] The primary spillway is a drop inlet structure consisting of a single stage reinforced concrete riser, a 48-inch-diameter reinforced concrete conduit, and a reinforced concrete impact basin at the downstream end. The emergency spillway is a trapezoidal earth channel excavated into the right abutment. An 18-inch reinforced concrete wall extending 10 feet into the rock constitutes the overflow control section of the emergency spillway. The reservoir drain facilities for the dam consist of a reinforced concrete intake structure located near the upstream toe of the embankment and a 30-inch-diameter reinforced concrete conduit discharging into the drop inlet structure. Flow through the reservoir outlet pipe is controlled by a manually operated sluice gate located in the drop inlet structure. The reservoir outlet system constitutes the emergency drawdown facility for the dam.

b. Location. The dam is located on Robinson Fork, a tributary of Wheeling Creek, about one mile east of Majorsville, West Virginia, in West Findley Township, Washington County, Pennsylvania (Plate 1).

Downstream from the dam, Robinson Fork flows approximately 2000 feet southwest and joins Wheeling Creek. An industrial warehouse located

at the confluence of Robinson Fork and Wheeling Creek is the only structure located in the Robinson Fork valley. Below the confluence, Wheeling Creek flows through a narrow valley. The community of Alley Grove, which consists of approximately 20 homes, is located approximately one mile downstream from the dam. A major natural gas pump station is also located within this reach. It is estimated that the failure of the dam would cause large loss of life and property damage in Alley Grove and further downstream.

c. Size Classification. Intermediate (based on 95-foot height and 6500 acre-feet maximum storage capacity).

d. Hazard Classification. High (based on downstream conditions).

e. Ownership. Wheeling Creek Watershed Commission (address: Mr. James D. Ealy, Manager, Wheeling Creek Watershed Commission, Room 513, County Office Building, Waynesburg, Pennsylvania 15370).

f. Purpose of Dam. Flood control.

g. Design and Construction History. The dam was designed by the U.S. Department of Agriculture, Soil Conservation Service, during 1972 and 1973. The dam was constructed by Monroeville Construction Company of Monroeville, Pennsylvania, with completion on July 7, 1977.

h. Normal Operating Procedure. The reservoir is normally maintained at Elevation 876, the elevation of uncontrolled primary spillway crest. The crest of the emergency spillway is at Elevation 920. Inflow occurring when the lake level is above the primary spillway crest level but below the emergency spillway is discharged through the uncontrolled primary spillway.

1.3 Pertinent Data

a. Drainage Area - 22.4 square miles

b. Discharge at Dam Site (cfs)

Maximum known flood at dam site - Unknown
Outlet conduit at maximum pool - 419 (pool at El. 920)
Gated spillway capacity at maximum pool - N/A
Ungated spillway capacity at maximum pool - 50,400
Total spillway capacity at maximum pool - 50,400

c. Elevation (USGS Datum) (feet)

Top of dam - 937.6
Maximum pool - 937.6
Normal pool - 876
Upstream invert outlet works - 845.75
Downstream invert outlet works - 842.68
Streambed at center line of dam - 842±
Maximum tailwater - Unknown

d. Reservoir Length (feet)

Normal pool level - 5200
Maximum pool level - 10,000 (estimated)

e. Storage (acre-feet)

Normal pool level - 279
Maximum pool level - 6500

f. Reservoir Surface (acres)

Normal pool - 33
Maximum pool - 180

g. Dam

Type - Earth
Length - 500 feet
Height - 95 feet
Top width - 15 feet
Side slopes - Downstream: 3H:1V; Upstream: 3H:1V
Zoning - Yes
Impervious core - Yes
Cutoff - Yes
Grout curtain - No

h. Regulating Outlet

Type - 30-inch-diameter reinforced concrete conduit
Length - 50± feet
Closure - Sluice gate at drop inlet structure
Access - Drop inlet structure
Regulating facilities - Sluice gate

i. Spillway

	Primary	Emergency
Type -	Drop inlet	Trapezoidal earth channel
Length -	N/A	200 feet
Crest elevation -	876	920
Gates -	None	None
Upstream channel -	Lake	Trapezoidal earth channel
Downstream channel -	48-inch outlet conduit	Trapezoidal earth channel

SECTION 2
DESIGN DATA

2.1 Design

a. Data Available. The available information was provided by the Soil Conservation Service (SCS) and the Pennsylvania Department of Environmental Resources (PennDER).

(1) Hydrology and Hydraulics. The available information consists of principal, freeboard, and emergency spillway inflow hydrographs and associated flood routings.

(2) Embankment. The available information consists of design drawings, geology and soil reports, laboratory soil test results, and the results of slope stability and seepage analyses.

(3) Appurtenant Structures. Available information includes design drawings and design calculations.

b. Design Features

(1) Embankment

a. As designed, the dam is a zoned embankment consisting of a central impervious core and upstream and downstream shell sections (Plates 2 and 3). The core section extends to top of foundation rock through a cutoff trench excavated at the center of the embankment (Plate 4). The internal drainage system for the embankment consists of a 3-foot-thick filter blanket located under the downstream toe (Plate 5). The blanket starts at a point 200 feet downstream from the axis of the dam and terminates near the downstream toe of the embankment. The width of the blanket varies from 50 to 75 feet. The blanket also extends up the abutments to a level approximately 60 feet below the dam crest elevation.

The embankment materials were classified as residual silty clays with liquid limits ranging from 36 to 44 percent and plasticity indices from 12 to 18 percent for the impervious core (Zone I), compacted weathered shale for the upstream shell (Zone II), and sandstone and limestone for downstream shell (Zone III).

b. The dam was designed to have 3 to 1 (horizontal to vertical slopes on both the downstream and upstream faces. On the downstream slope, a 10-foot-wide bench is located at Elevation 895. A 14-foot-wide bench on the upstream slope is located at Elevation 876 (normal pool level).

c. The subsurface investigation conducted for the dam consists of numerous borings and test pits. The locations of these borings are shown in Plate 6. Selected boring logs are illustrated in plates 7 and 8. The typical subsurface profile (Plate 4) consists of three to five feet of medium to stiff sandy clayey silts on the valley sides and about 12 feet of loose to dense sand and gravel and clayey sands at the valley floor. The rock beneath the site includes alternating layers of limestone, calcareous shale, carbonaceous shale, coal, and calcareous sandstone. The Waynesburg coal seam was encountered 80 to 90 feet below the dam crest level. The rocks at the dam site were described as having horizontal bedding planes with distinct joint patterns. The weathering was assessed to be more pronounced on the abutments, extending to a depth of 20 feet, while the weathering in the valley bottom was estimated to be less than 20 feet. Both the weathered and unweathered rock in the valley bottom was found to be relatively permeable. Results of field tests indicate that the permeability of the foundation rock ranged between 19 feet per day (7×10^{-3} cm/sec) to more than 50 feet per day (2×10^{-3} cm/sec). These high permeabilities occurred in the Uniontown Limestone, which was encountered at about 30 to 35 feet below the average ground surface.

(2) Appurtenant Structures. The appurtenant structures of the dam include drop inlets, primary spillway, and an emergency spillway. The primary spillway consists of a single-stage reinforced concrete riser, a 48-inch-diameter reinforced concrete conduit through the embankment, terminating at a reinforced concrete impact basin at the downstream toe of the dam (Plates 9, 10 and 11). A 30-inch-diameter reinforced concrete pipe which receives flow from an intake structure located at the upstream toe of the dam and which discharges into the primary spillway drop inlet structure constitutes the reservoir drain

facilities for the dam. Both the reservoir drain and primary spillway pipes are supported on continuous reinforced concrete cradle equipped with reinforced concrete cutoff collars (Plate 12).

The emergency spillway is a trapezoidal earth channel excavated into the right abutment. The bottom width of the trapezoidal channel is 200 feet with side slopes 3:1 on the embankment side and 2:1 on the abutment side. The control section of the spillway is at Elevation 920 and consists of an 18-inch-thick concrete wall extending 10 feet into the rock (Plates 13 and 14).

c. Design Data

(1) Hydrology and Hydraulics. Available information indicates that the emergency spillway was designed to pass a hydrograph with a peak of 52,680 cfs, corresponding to 24.38 inches of precipitation in 6 hours, without overtopping the embankment. This hydrograph was routed through the reservoir starting at normal pool elevation (Elevation 876), which produced a maximum pool level at Elevation 937.6 with a peak emergency spillway outflow of 50,936 cfs. The top of the dam was established at Elevation 937.6.

(2) Embankment. Laboratory tests for the embankment design consisted of classification, compaction, consolidation, permeability, and shear strength tests. Consolidation tests performed on samples compacted to 100 percent of Standard Proctor maximum dry density showed a consolidation potential of 2.3 percent of embankment height, a total settlement of 2 feet. The dam crest was cambered by 2 feet to compensate for the expected settlement. The permeability of the core material was estimated to be 0.008 foot per day (10^{-6} cm/sec). Shear strength parameters of the core material were obtained from consolidated-undrained triaxial shear tests with pore pressure measurements. Tests were conducted on samples compacted to 100 percent Standard Proctor maximum dry density. The effective strength parameters for six potential core materials ranged from an effective internal friction angle of 23.5 to 31 degrees and effective cohesion of 250 to 700 psf. It is reported that a slope stability analysis was conducted utilizing modified Swedish circle and sliding block procedures. The stability of the downstream slope under steady-state seepage and stability of the upstream slope under rapid drawdown conditions were considered. For steady seepage, pool level was taken at Elevation 920, the emergency spillway crest level. Results of the sliding block stability analyses were available for review. The minimum computed factor of safety was 2.1 for the downstream slope under steady-state seepage conditions and 1.4 for the upstream slope under rapid drawdown conditions.

(3) Appurtenant Structures. Available information indicates that the appurtenant structures were standard SCS designs.

2.2 Construction. As-built drawings and construction progress reports prepared by PennDER were available for review. To the extent that can be determined, the construction of the dam was in conformance with the SCS specifications. The dam was constructed under the supervision of an SCS field representative. It is reported that the earthwork was monitored by field density tests. However, the results were not available for review.

One significant construction change was noted. During the excavation of the cutoff trench, a limestone layer was encountered with solution channels. To prevent seepage through this layer, the cutoff trench was widened and Zone I was carried down on a slope 0.5 horizontal to 1 vertical past the limestone layer.

No post-construction changes were reported.

2.3 Operation. No records of operation are kept.

2.4 Other Investigations. None reported.

2.5 Evaluation

a. Availability. Available information was obtained from SCS and PennDER.

b. Adequacy

(1) Hydrology and Hydraulics. The available information is considered to be adequate to assess the conformity of the design to the current spillway design criteria.

(2) Embankment. Review of the geotechnical aspects of the design indicates that the design generally followed currently accepted practice for subsurface investigation, laboratory testing, and stability analyses.

(3) Appurtenant Structures. Review of the design drawings indicates that the appurtenant structures were designed and constructed in conformance with currently accepted engineering practices.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The on-site inspection of PA-647 dam consisted of:

1. Visual inspection of the embankment, abutments, and embankment toe.

2. Visual examination of the emergency spillway and visible portions of the primary spillway.

3. Observation of factors affecting runoff potential of the drainage basin.

4. Evaluation of downstream area hazard potential.

The specific observations are illustrated in Plate 15 and in the photographs in Appendix C.

b. Embankment. The general inspection of the embankment consisted of searching for indications of structural distress, such as cracks, subsidence, bulging, wet areas, seeps and boils, and observing general maintenance conditions, vegetative cover, erosion, and other surficial features.

In general, the condition of the dam is considered to be good. Only one wet area was observed on the downstream slope near the left abutment below the berm. No perceivable seepage was associated with this wet area. Also, several erosion ditches were observed on the upstream and downstream faces of the dam.

The top of the dam was surveyed relative to the emergency spillway crest elevation and was found to be within two-tenths of a foot of the design elevation with camber.

c. Appurtenant Structures. The appurtenant structures were examined for deterioration or other signs of distress or obstructions that would limit flow. In general, the structures were found to be in good condition. No deficiencies were noted at this time.

d. Reservoir Area. A map review indicates that the watershed is predominantly covered with woodlands. A review of the regional geology (Appendix E) indicates that the slopes of the reservoir are likely to be susceptible to landslides. However, massive landslides which may affect the storage volume of the reservoir are considered to be unlikely.

e. Downstream Channel. Downstream from the dam, Robinson Run flows approximately 2000 feet southwest where it joins Wheeling Creek. Further description of downstream conditions is included in Section 1.2b.

3.2 Evaluation. The condition of the dam is considered to be good. A wet spot on the downstream face of the dam should be periodically observed to document if a seepage condition is developing. Erosion ditches on the upstream and downstream faces of the dam should be filled to prevent further erosion.

SECTION 4
OPERATIONAL FEATURES

4.1 Procedure. The reservoir is normally maintained at the primary spillway crest level with excess inflow discharging through the primary spillway. The reservoir outlet pipe can be used to draw down the permanent pool when required. The reservoir outlet pipe gate is normally closed.

4.2 Maintenance of the Dam. The maintenance of the dam is considered to be satisfactory. The downstream and upstream faces of the dam are covered with grass and appear to be annually mowed. The Wheeling Creek Watershed Commission reported that there is no full-time dam tender responsible for the maintenance of the dam. The dam is maintained by Commission personnel as required.

4.3 Maintenance of Operating Facilities. The only operational feature of the dam is the reservoir outlet pipe sluice gate operated by a hoist located on the primary spillway drop inlet structure. Since the top of the drop inlet structure was not accessible, this facility could not be closely examined.

4.4 Warning System. Wheeling Creek Watershed Commission reported that a remote flood stage warning system is located approximately six to seven miles downstream from the dam which initiates an alarm in the civil defence facilities in Wheeling, West Virginia.

4.5 Evaluation. The maintenance condition of the dam is considered to be satisfactory. The dam and appurtenances should be periodically inspected with emphasis on the wet area on the downstream slope to document if the conditions are changing and necessary maintenance performed when required.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. PA-647 dam has a watershed of 22.4 square miles and impounds a reservoir with a surface area of 33 acres at normal pool level. The emergency spillway of the dam is located on the right abutment. The capacity of the emergency spillway is reported to be 50,936 cfs with no freeboard.

b. Experience Data. As previously stated, PA-647 dam is classified as an intermediate dam in the high hazard category. Under the recommended criteria for evaluating emergency spillway discharge capacity, such impoundments are required to pass full probable maximum flood (PMF).

The PMF inflow hydrograph for the reservoir was determined using the Dam Safety Version of the HEC-1 computer program, developed by the Hydrologic Engineering Center of the U.S. Army, Corps of Engineers. The data used for the computer input are presented in Appendix D. The PMF inflow hydrograph was found to have a peak flow of 25,331 cfs. The computer outputs are included in Appendix D.

c. Visual Observations. On the date of inspection, no conditions were observed that would indicate that the emergency spillway capacity would be significantly reduced in the event of a flood.

d. Overtopping Potential. PMF inflow hydrograph was routed through the reservoir and it was found that the dam can pass 100 percent PMF without overtopping. To obtain an upper bound on the maximum pool level during the passage of PMF, the spillway discharge rating was conservatively based on a rectangular cross section, with the base of the rectangle taken equal to the base of the trapezoidal emergency spillway cross section.

e. Spillway Adequacy. The spillway capacity (greater than 100 percent PMF) is classified to be adequate according to the recommended criteria.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

(1) Embankment. As discussed in Section 3, the field observations did not reveal any signs of distress that would significantly affect the stability of the embankment at this time. However, it should be understood that since the dam is a flood control facility and was at normal pool at the time of inspection, it was not under maximum loading conditions. Maximum loading occurs only during the passage of major floods.

(2) Appurtenant Structures. Performance of the appurtenant structures is considered to be satisfactory.

b. Design and Construction Data

(1) Embankment. Available information indicates that the stability of the embankment was analyzed for steady seepage and rapid drawdown conditions using the modified Swedish circle and sliding block slope stability analysis procedures. The minimum factor of safety was reported to be 2.1 for the steady-state seepage stability of the downstream slope and 1.4 for the rapid drawdown condition of the upstream slope. Strength parameters for the core material were obtained from consolidated-undrained triaxial shear tests with pore pressure measurements. Assumed strength parameter values were used for the shell materials. Construction progress reports indicate that the dam was constructed under the supervision of an SCS field representative, and the earthwork was monitored by field density tests.

(2) Appurtenant Structures. Review of the design drawings indicates that there are no apparent structural deficiencies that would significantly affect the performance of the appurtenant structures.

c. Operating Records. There are no operating records kept for the dam.

d. Post-Construction Changes. None reported.

e. Seismic Stability. The dam is located in Seismic Zone 1, and based on visual observations, the static stability of the dam is considered to be adequate. Therefore, based on the recommended criteria for evaluation of seismic stability of dams, the structure is presumed to present no hazard from earthquakes.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

a. Assessment. The visual observations indicate that PA-647 dam is in good condition. No conditions were observed that would significantly affect the overall performance of the structure at this time. However, as previously noted, the dam was not inspected under its maximum loading condition, which would occur when the reservoir is filled during major storms.

The wet area observed at the downstream face of the dam is not considered to be serious relative to the overall performance of the dam at this time. However, this area should be periodically observed to determine if a seepage condition is developing.

The capacity of the spillway was found to be adequate according to the recommended criteria.

b. Adequacy of Information. Available information in conjunction with the visual observations and the previous experience of the inspectors are considered to be sufficient to make a reasonable assessment of the condition of the dam.

c. Urgency. The following recommendations should be implemented on a continuing basis.

d. Necessity for Additional Data. No additional data is considered to be required at this time.

7.2 Recommendations/Remedial Measures. It is recommended that:

1. The wet area located on the downstream slope should be periodically observed. Necessary remedial work should be performed if the extent of the wet area increases or sloughing and seepage develops.

2. Around-the-clock surveillance should be provided during unusually heavy runoff and a formal warning system should be developed to alert downstream residents in the event of emergencies.

3. The dam and appurtenant structures should be inspected regularly and necessary maintenance should be performed.

PLATES

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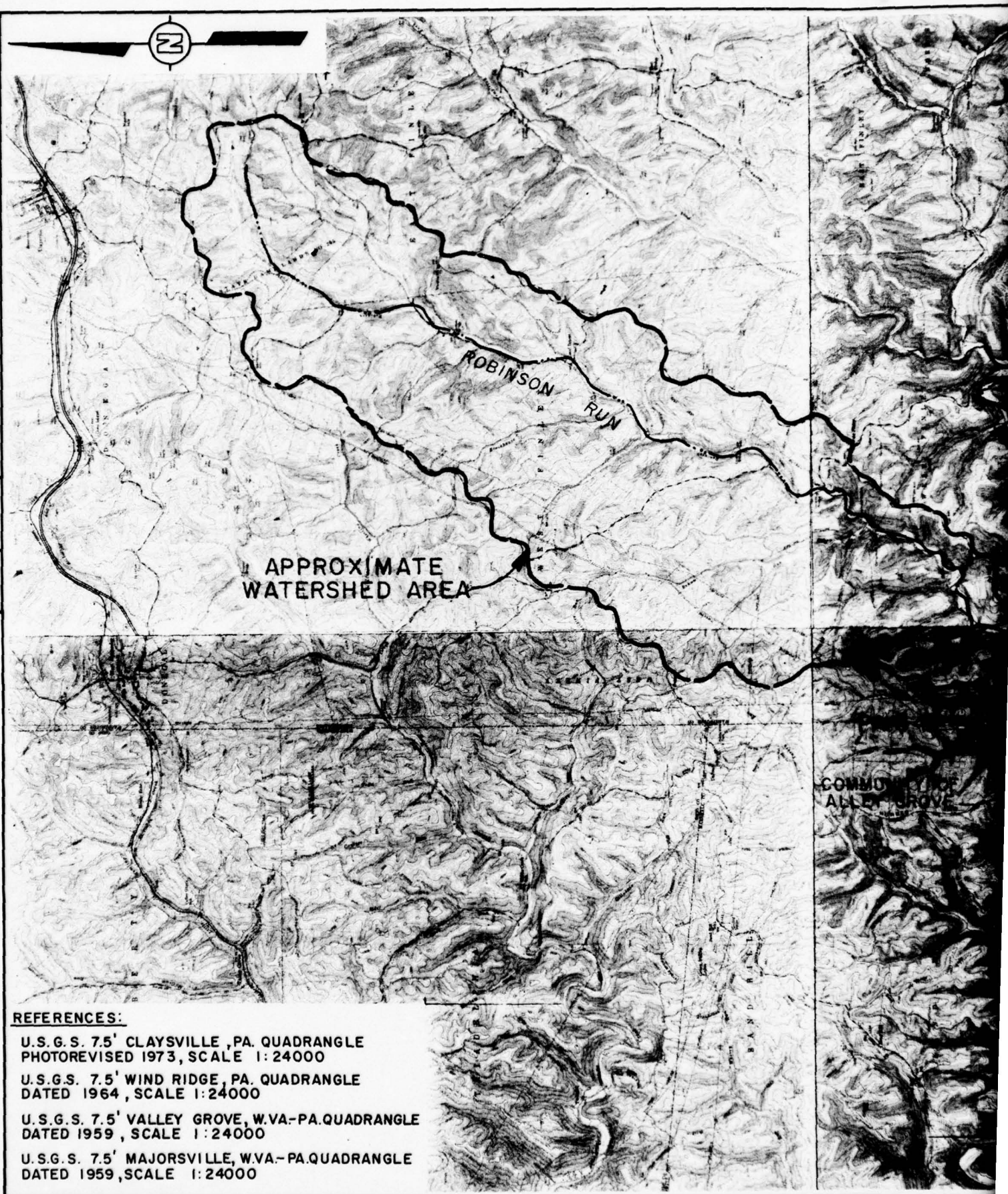

REFERENCES:

U.S.G.S. 7.5' CLAYSVILLE, PA. QUADRANGLE
PHOTOREVISED 1973, SCALE 1:24000

U.S.G.S. 7.5' WIND RIDGE, PA. QUADRANGLE
DATED 1964, SCALE 1:24000

U.S.G.S. 7.5' VALLEY GROVE, W.VA.-PA. QUADRANGLE
DATED 1959, SCALE 1:24000

U.S.G.S. 7.5' MAJORSVILLE, W.VA.-PA. QUADRANGLE
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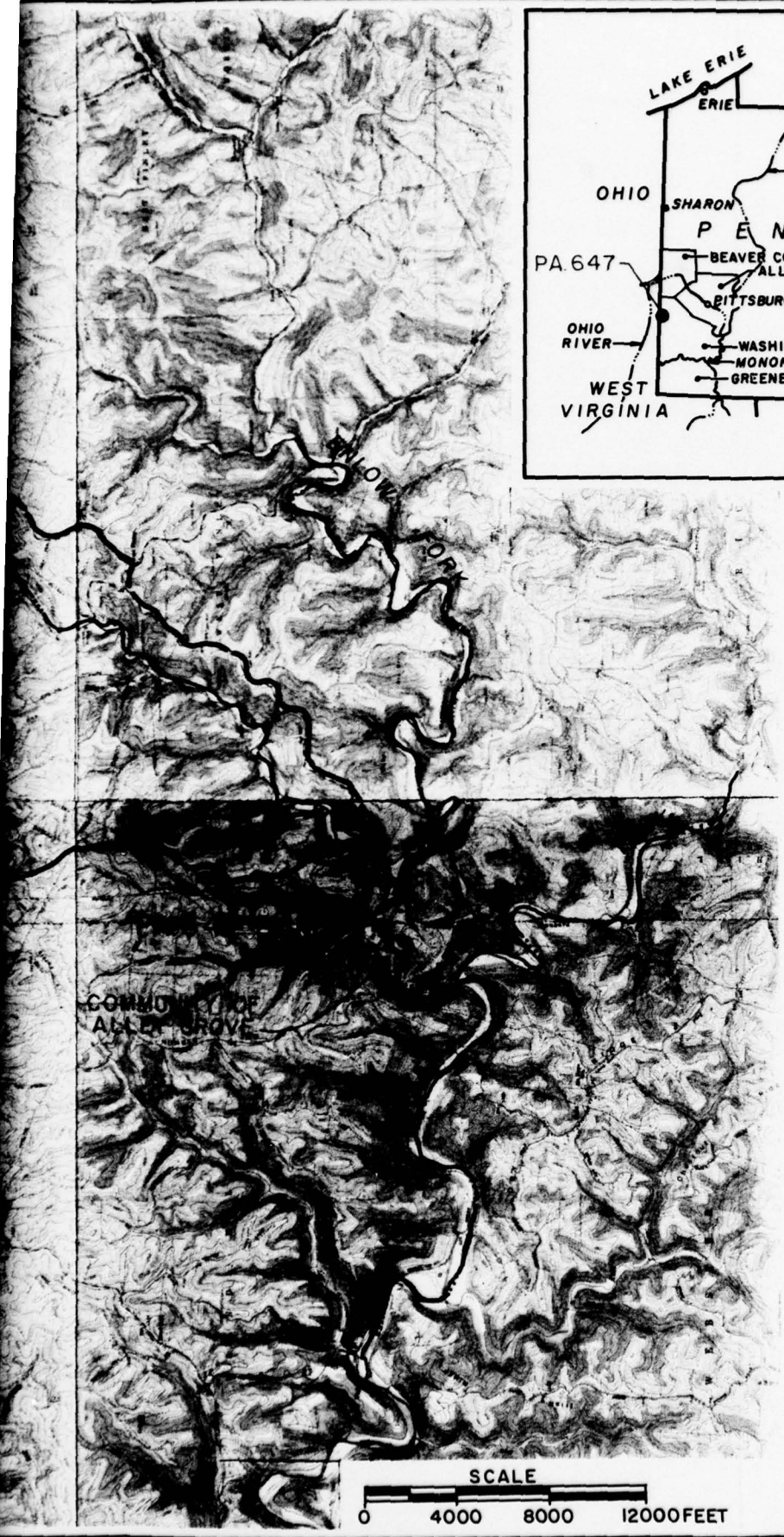

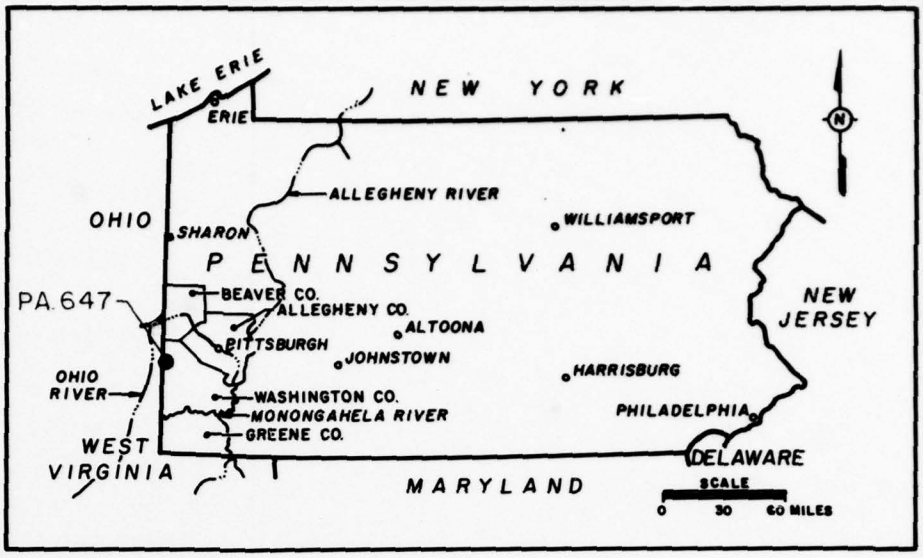

KEY PLAN

PLATE I

PA. 647 DAM
VICINITY, FLOOD PLAIN & WATERSHED MAP

D'APPOLONIA

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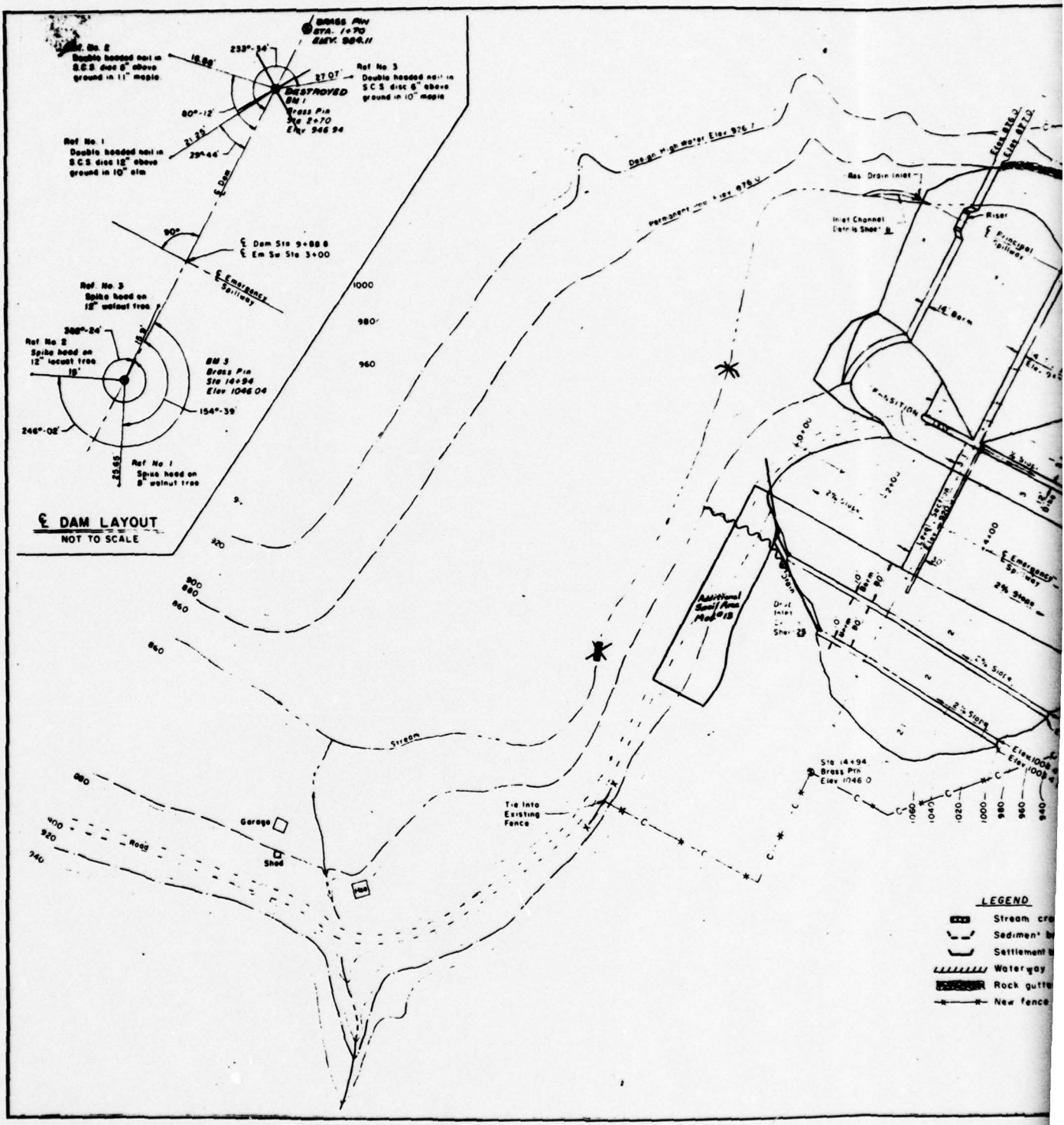

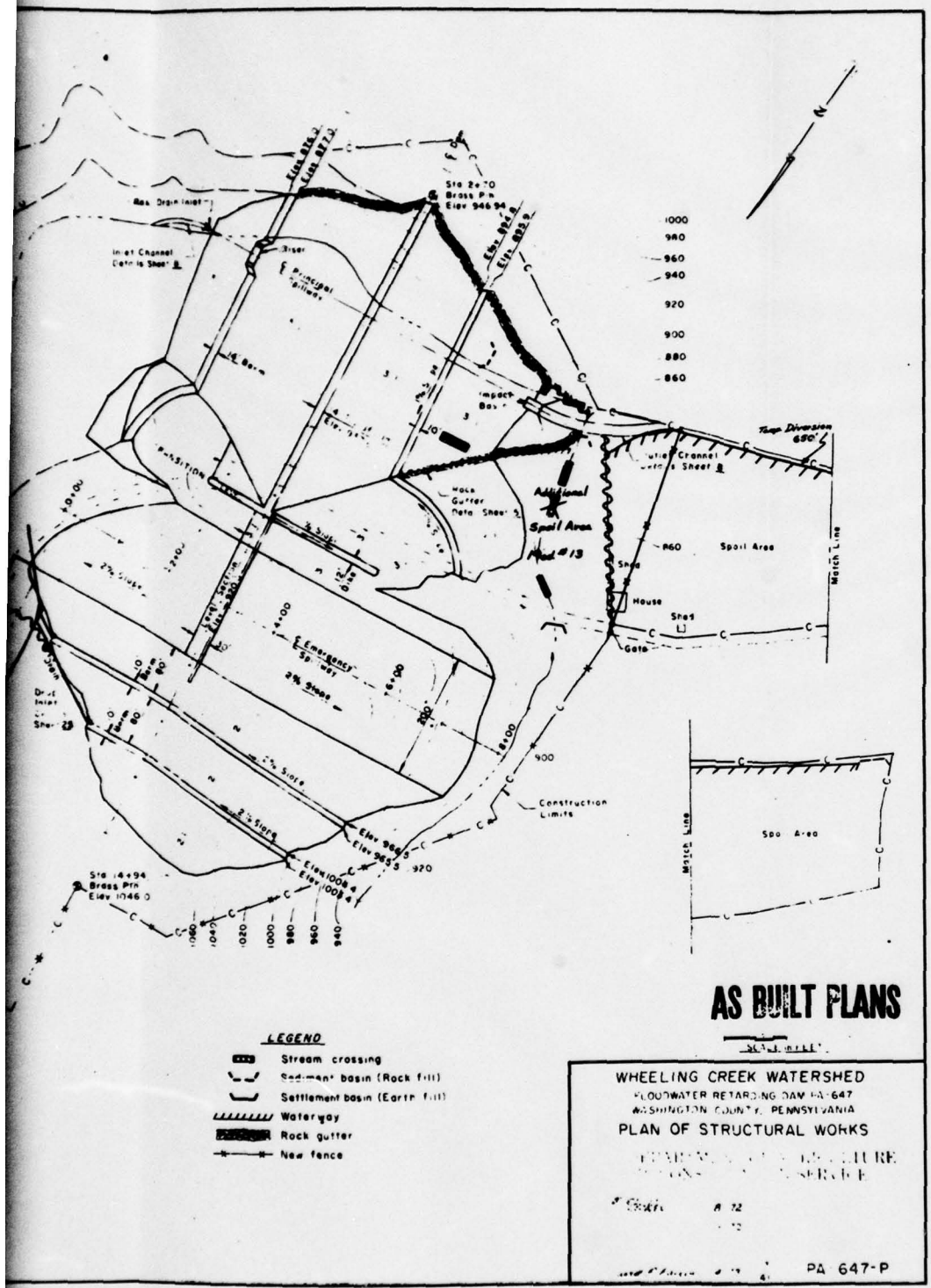

AS BUILT PLANS

LEGEND

- Stream crossing
- Sediment basin (Rock fill)
- Settlement basin (Earth fill)
- Waterway
- Rock gutter
- New fence

WHEELING CREEK WATERSHED
FLOODWATER RETARDING DAM PA-647
WASHINGTON COUNTY, PENNSYLVANIA
PLAN OF STRUCTURAL WORKS

PA 647-P

PLATE 2

D'APPOLONIA

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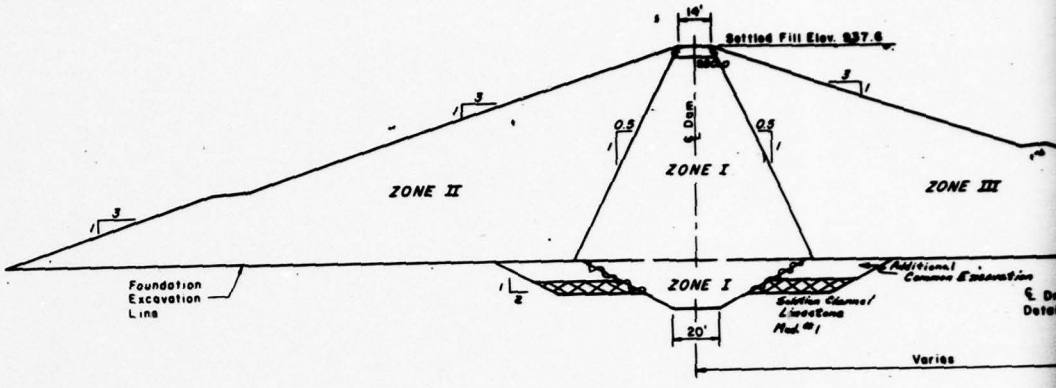


TYPICAL SECTION OF DAM

0 10 20 30 60 FEET
SCALE

SELECTIVE PLACEMENT	MATERIAL	MAX. ROCK SIZE	MAX. [1] LIFT	REQ'D. [2] WATER CONTENT	COMPACTION [3] CLASS	COMPACTION [3] DEFINITION
ZONE I [4]	Material as represented by TP-202, depth 1.0' to 4.0', and TP-210, depth 5.0' to 8.0', classified as CL and ML respectively. Weathered shales (hardness 2 or less) (GC, SC, GM, SM) excavated from Em. Sw.	6"	9"	Optimum -1% to +3%	A	100% Max. density by ASTM D-698, Method "A".
ZONE II [4]	Shale excavated from Emergency Spillway.	12"	18"	As designated by the Engineer	C	Compact with min. six passes of 450 p.s.i. tamping roller per lift.
ZONE III [4]	Sandstone and Limestone excavated from Emergency Spillway.	12"	18"	As designated by the Engineer	C	Compact with min. six passes of 450 p.s.i. tamping roller per lift.

[1] Maximum permissible lift thickness before compaction.

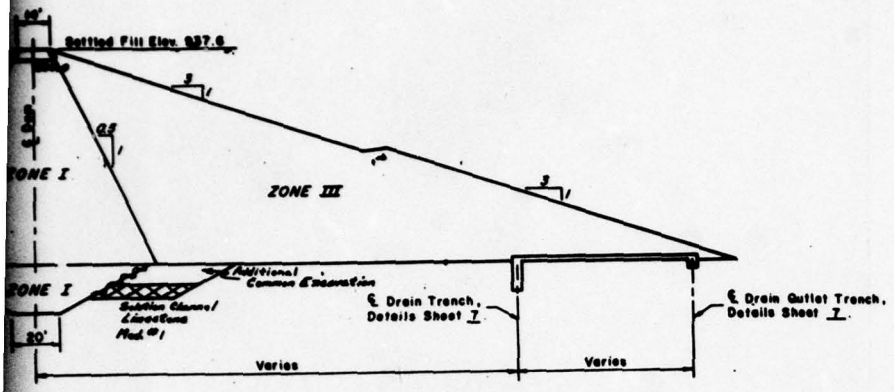
[2] Water content of fill matrix at time of compaction. Variation from water content shown may be approved by the Engineer.

[3] For typical compaction curves, see sheets 40 and 41

[4] Selective placement of material within zones will be required

CONSTRUCTIO

1. Constructed Sl
   2.93:1 Upstr
   2.93:1 Downs
2. For constructed
   see sheet 8



ECTION OF DAM

0 30 60 FEET
SCALE

CONSTRUCTION NOTES

1. Constructed Slopes are:
   2.93:1 Upstream
   2.93:1 Downstream
2. For constructed fill elevations, see sheet 6.

AS BUILT PLANS

WHEELING CREEK WATERSHED
FLOODWATER RETARDING DAM PA 647
WASHINGTON COUNTY, PENNSYLVANIA
FILL PLACEMENT

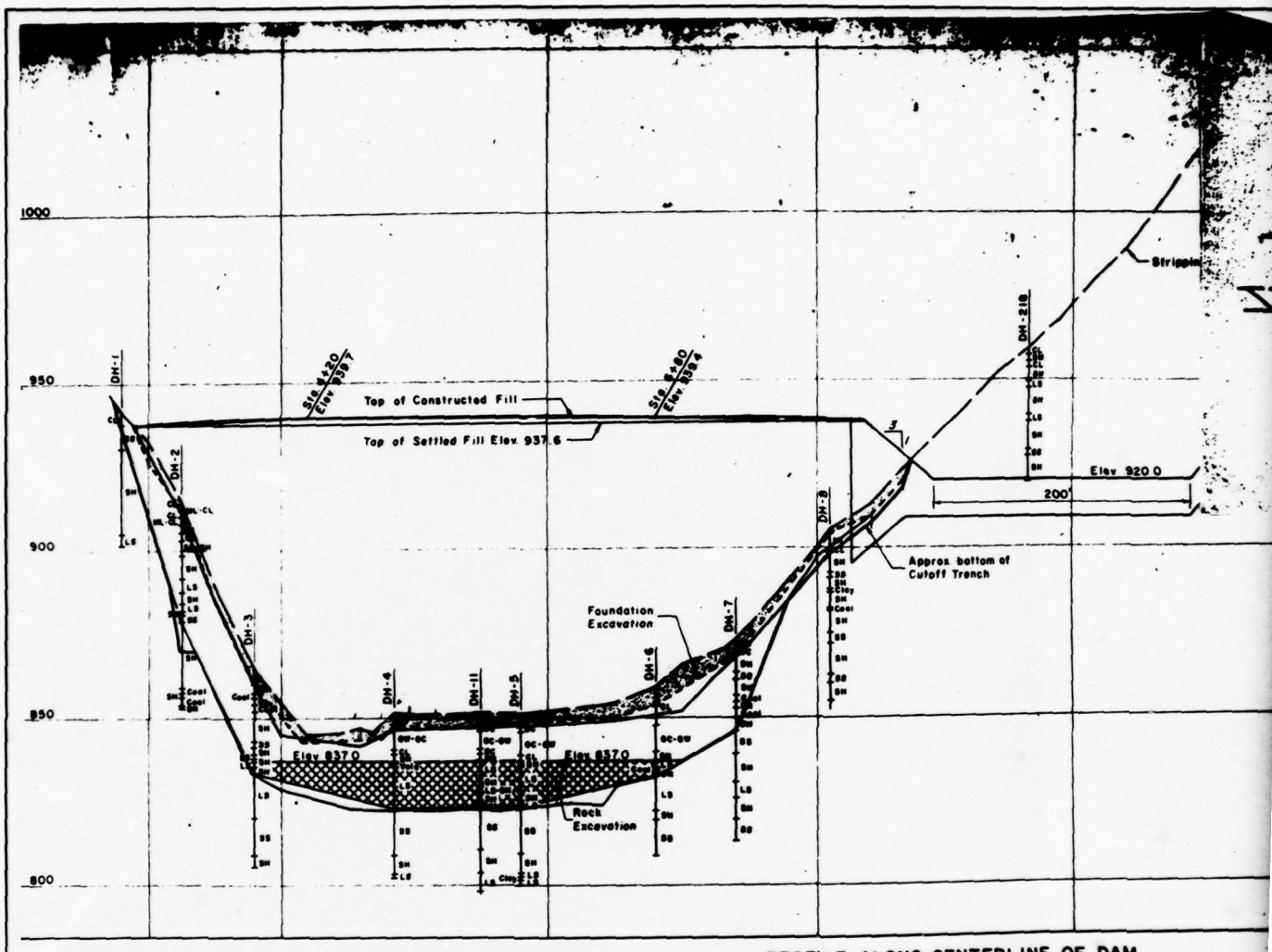
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	L Stabler	Date 10-72	Approved by
Drawn	R A STALTER	11-72	Title
Traced			Date
Checked	Jos P Fowler	9-73	Sheet No. 4 of 41 — Drawing No. PA-647-P

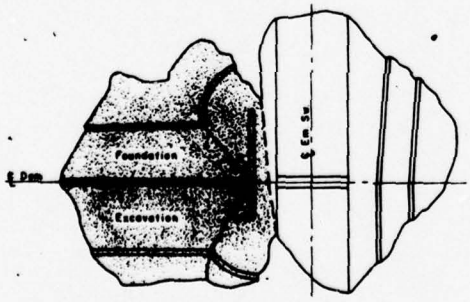
PLATE 3

D'APPOLONIA

DRAWN BY	ACS	CHECKED BY	BE	3/1/79	DRAWING NUMBER 78-367-B40
	1-3-79	APPROVED BY	JHD	3.1.79	

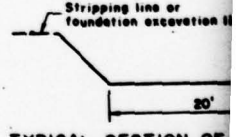


PROFILE ALONG CENTERLINE OF DAM



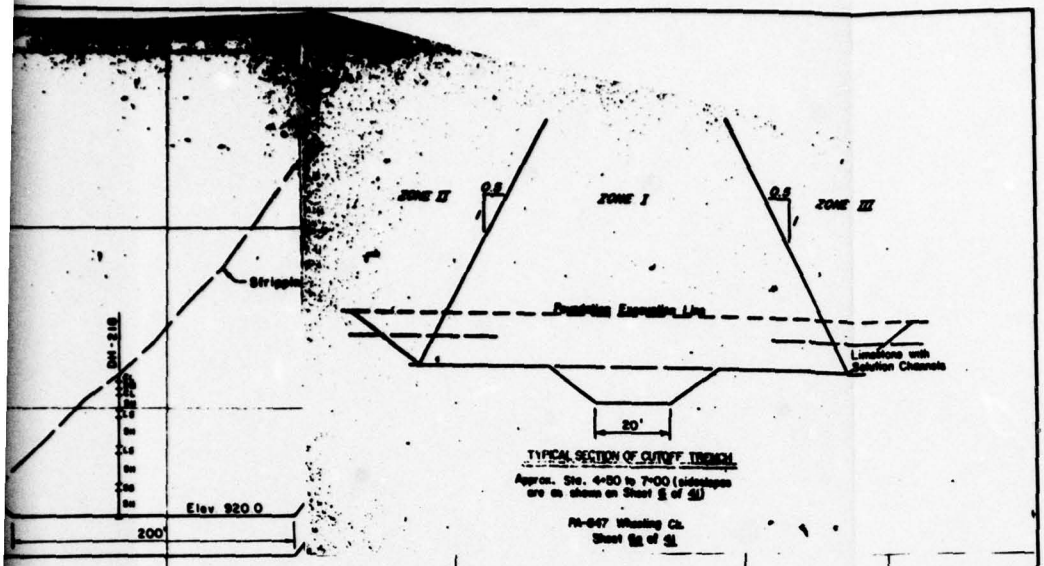
PLAN VIEW OF FOUNDATION EXCAVATION

0 100 200 300 FEET
SCALE

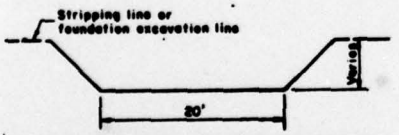


TYPICAL SECTION OF

SIDESLOPES	
2:1	
transition	
4:1	
transition	
2:1	



CENTERLINE OF DAM



TYPICAL SECTION OF CUTOFF TRENCH

SIDESLOPES	STATION
2:1	4+78 to 4+93
transition	4+93 to 4+98
4:1	4+98 to 4+88
transition	4+88 to 5+11
2:1	5+11 to 5+70

CONSTRUCTION NOTES

1. For logs of test holes see sheets 32 thru 32.
2. ℄ Dam = ℄ Cutoff trench.

AS BUILT PLANS

WHEELING CREEK WATERSHED
FLOODWATER RETARDING DAM PA-647
WASHINGTON COUNTY, PENNSYLVANIA
PROFILE ALONG ℄ DAM

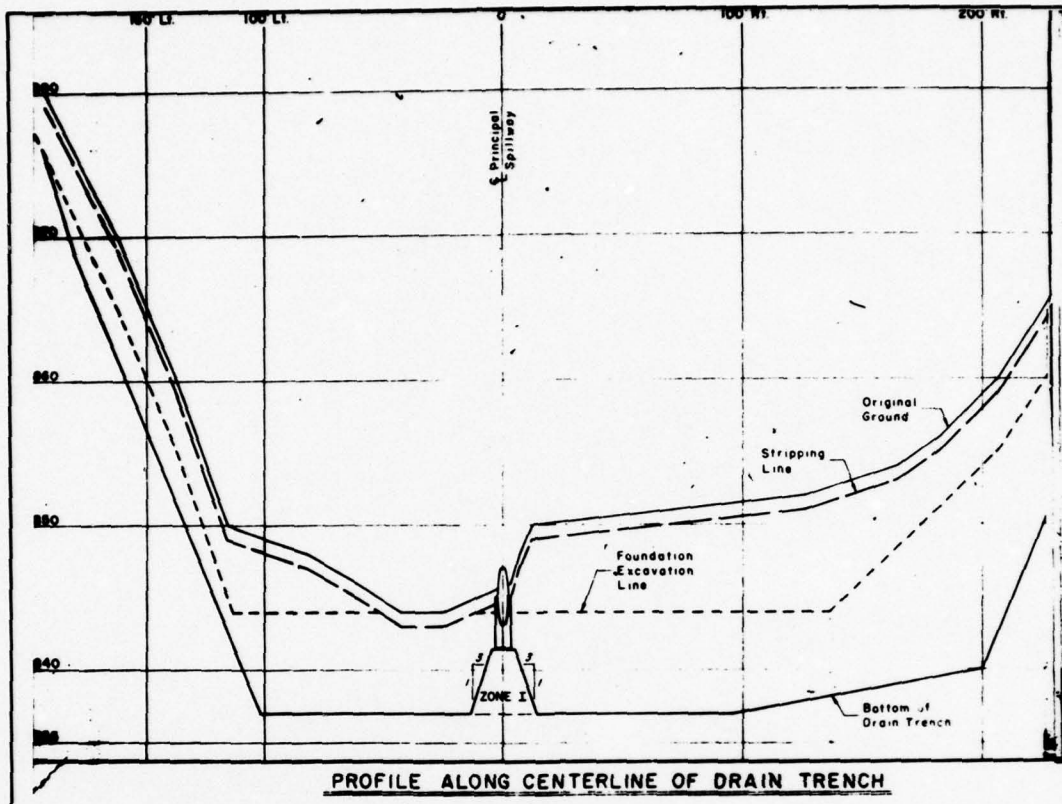
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	E. Stalter	Date 8-72	Approved by
Drawn	R. A. STALTER	9-72	
Traced			
Checked	Daniel P. Fowler 4-73	Sheet No. 6 of 41	PA-647-P

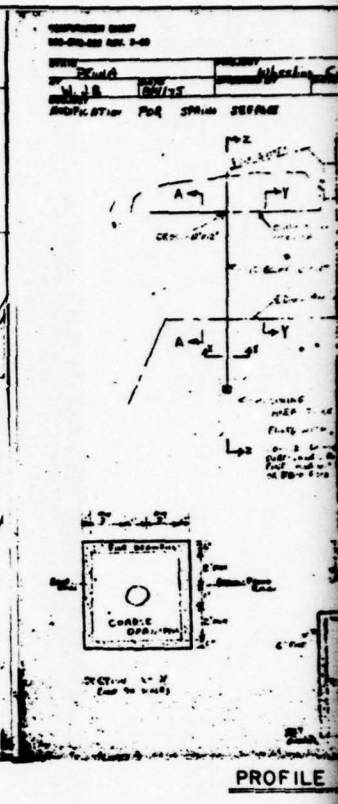
PLATE 4

D'APPOLONIA

DRAWN BY	ACS	CHECKED BY	BE	3/1/79	DRAWING NUMBER 78-367-B41
	1-3-79	APPROVED BY	JMP	3/1/79	

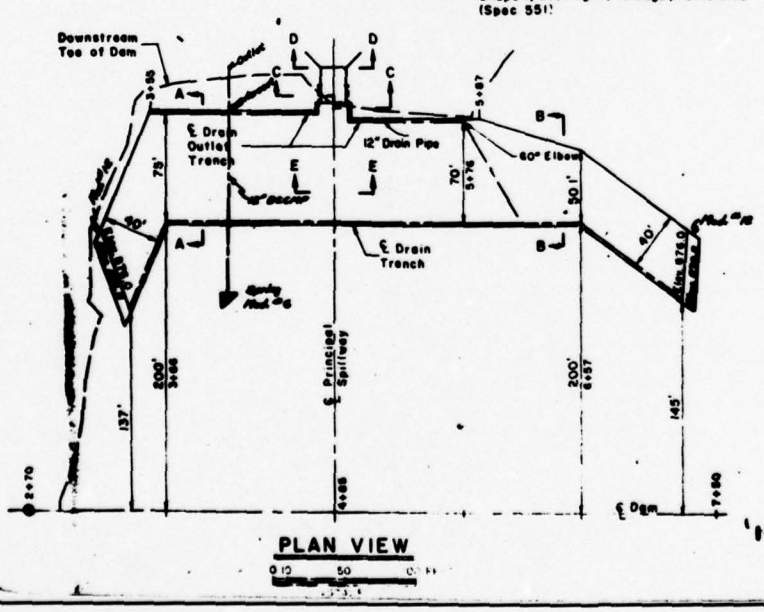


PROFILE ALONG CENTERLINE OF DRAIN TRENCH

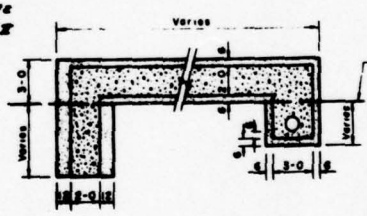


PROFILE

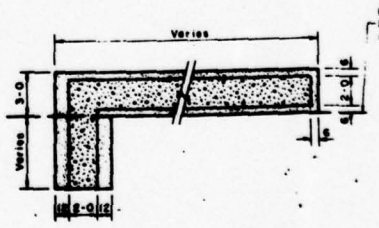
Note:
All drain pipe to be 12" Dia., Class I, or Class II Mod. per Shape 1, Coating A, 16 Gage, Perforated (Spec 551)



PLAN VIEW

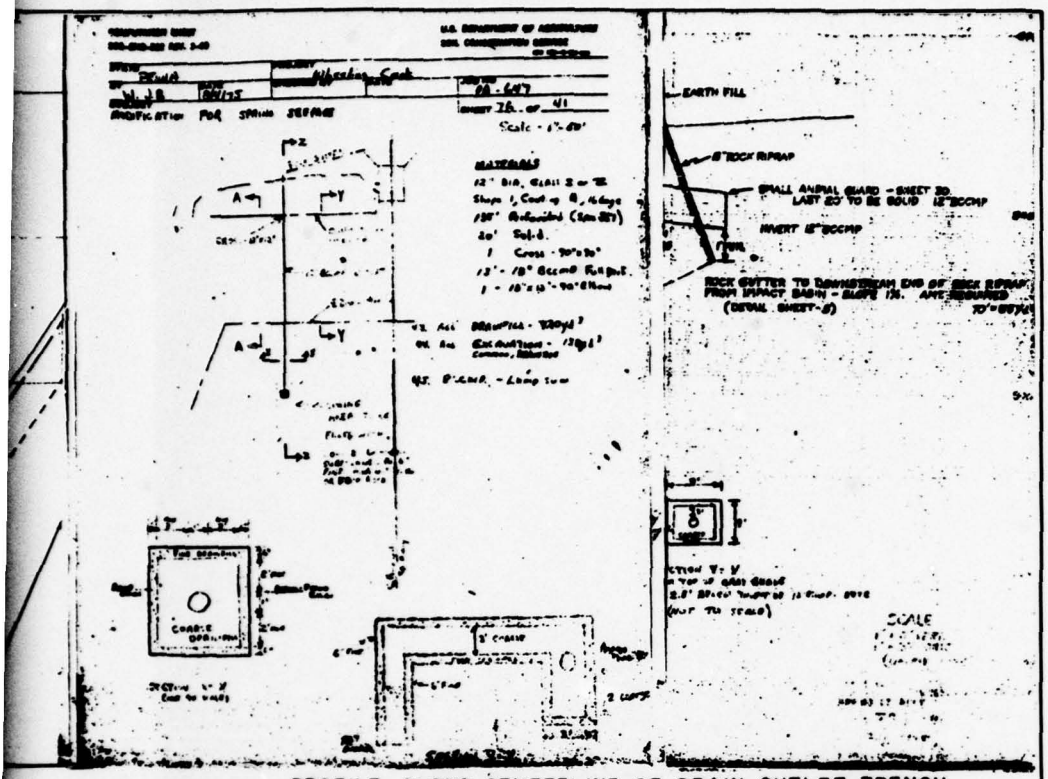


SECTION A-A

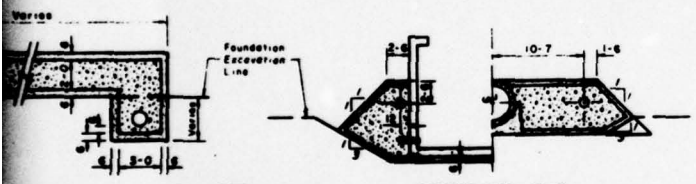


SECTION B-B

Note:
Fine drain fill may be omitted when it is to be placed next to rock.



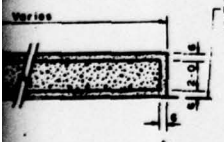
PROFILE ALONG CENTERLINE OF DRAIN OUTLET TRENCH

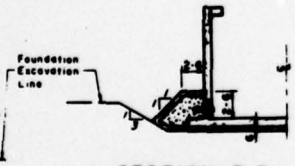


SECTION C-C

Fine Drain Fill
Coarse Drain Fill

TION A-A





SECTION D-D

SECTION E-E

TION B-B

...ipe 9)(l may be omitted when ...e placed next to rock.

PIPE QUANTITIES

304' - 12" Dia. Pipe
2 - 1' x 1' - 90° Elbows
2 - 1' x 2'-6" - 90° Elbows
1 - 1' x 1' - 60° Elbow
2 Metal End Caps
2 Small Animal Guards (Sheet 30)
317' Total

DRAIN FILL
GRADATION LIMITS

	SEIVE NO.	% PASSING (Based on Dry Weight)
FINE	½"	100
	No. 4	90-100
	No. 8	70-92
	No. 16	50-80
	No. 30	30-65
	No. 50	10-30
	No. 100	1-8
	No. 200	<3

	SEIVE NO	% PASSING (Based on Dry Weight)
COARSE	1"	100
	½"	90-100
	⅜"	20-55
	No. 4	0-10
		0-5

AS BUILT PLANS

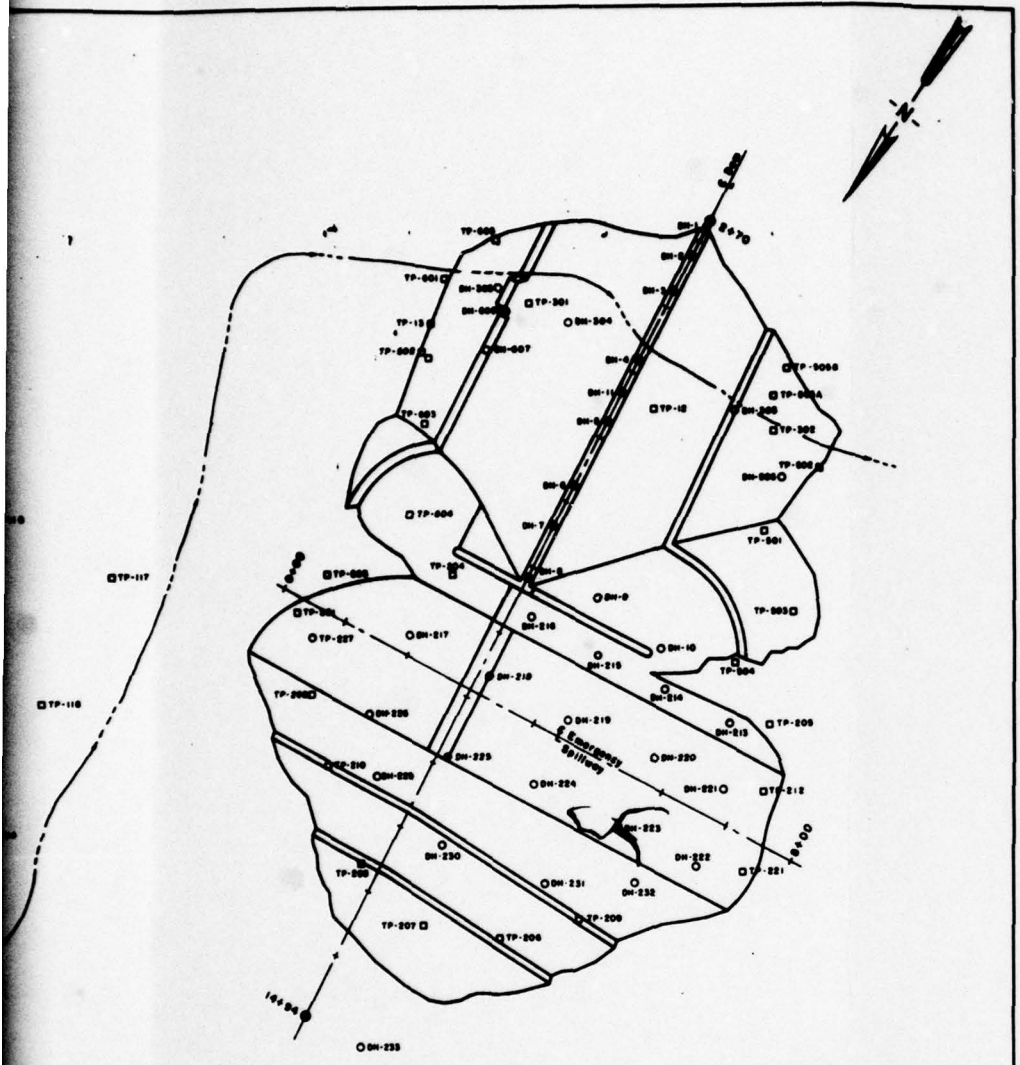
WHEELING CREEK WATERSHED
FLOODWATER RETARDING DAM TA-647
WASHINGTON COUNTY, PENNSYLVANIA
FOUNDATION DRAINAGE
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PA-647-P

PLATE 5

D'APPOLONIA

DRAWN BY	ACS	CHECKED BY	BE	3/1/79	DRAWING NUMBER	78-367-B42
	1-3-79	APPROVED BY	JHD	3.1.79		



AS BUILT PLANS

0 50 100 200 FEET
SCALE

WHEELING CREEK WATERSHED
FLOODWATER RETARDING DAM PA-647
WASHINGTON COUNTY, PENNSYLVANIA
LOCATION OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date		
Designed		Approved by	
Drawn R A STALTER	12-72	Title	
Traced		Title	
Checked C. Stechler	12-72	Sheet No. 31 of 41	Drawing No. PA-647-P

PLATE 6

D'APPOLONIA

DRAWN BY | ACS | CHECKED BY | JMC | 3/1/79 | DRAWING NUMBER 78-367-B43
1-3-79 | APPROVED BY | JMP | 3.1.79

DH-2, ELEV. 912.3, 3+75, Centerline
Logged by: A. L. Miller & T. A. Bumper 7/17/70
Drilling Equipment: Joy Skid Rig - Rig #1

Hole From	Depth To	Description of Materials	Unif. Soil Class Symb.	STANDARD PENETRATION Blows per 6"	Type Bit Used	No.	Type	SAMPLES From Ft.	To Ft.	% Rec.
0.0	0.5	Topsoil, tree roots, some humus.		2-2-3	SpT	1	Jar	0.0	1.5	25
				2-4-5	"	2	"	1.5	3.0	15
0.5	4.3	Clay, sandy, gravelly, & silty with shale fragments, soft to medium, moist, brn. Note: Refusal at 4.5, Tricone to 5.0 to set core barrel, takes a lot of water. Lost water circulation at 7.3. Tricone to set core barrel under head.	CL	4-5-100	"	3	"	3.0	4.5	67
					Tri	4		4.5	5.0	0
					Dia	5	HQW	5.0	8.0	90
					"	6	"	8.0	13.0	88
					"	7	"	13.0	18.0	90
					"	8	"	18.0	23.0	100
					"	9	"	23.0	28.0	95
					"	10	"	28.7	33.0	100
					"	11	"	33.0	38.0	100
					"	12	"	38.0	43.0	100
4.3	11.0	Wea. micaceous, silty sandstone, yellow-brn to gry, thin to med. bedded. Becomes gry with coal streaks at 7.5'. Iron stains on bedding joints. Water recovered at 9.0'. Lower Member, Waynesburg Formation, Dunkard Group.								
11.0	27.3	Yellow brn shale, fractured & broken with vertical joints & seams. Some of joints & seams are clay filled. Some of the core fits well together when coming from barrel but much of it is just loose, sand & gravel size pieces, core becomes less fractured with depth & bedding joints occur at 3' lengths below 15.0' although vertical jointing persists. Hardness 2, soft. - 10" sandy shale zone at 20.0'.								
27.3	33.5	Black, bituminous, clay shale, med. bedded core pieces with fractures & clay filled joints, soft to mod. soft (hardness 2-3), clay seams - 31.0 - 33.3 - (1.3').								
33.5	40.0	Gry silty limestone, mod. soft (hardness 3), med. bedded, vertically jointed with clay seams, bedding joints are up to 1.0" but are generally less than 0.5". Lower member, Waynesburg Formation, Dunkard Group.								
40.0		End of boring. Ground-water data - WL (7/16/70) 19.0. WL (7/17/70) 24.5. WL (7/20/70) 25.3. WL (7/21/70) 25.1.								

DH-2, ELEV. 912.3, 3+75, Centerline
Logged by: A. L. Miller & T. A. Bumper 7/17/70
Drilling Equipment: Joy Skid Rig - Rig #1

Hole From	Depth To	Description of Materials	Unif. Soil Class Symb.	STANDARD PENETRATION Blows per	Type Bit Used	No.	Type	SAMPLES From Ft.	To Ft.	% Rec.
0.0	0.2	Topsoil		2-3-4	SpT	1	Jar	0.0	1.5	30
0.2	1.5	Clay, silty with some fine sand & sandy shale fragments, mod. brn.	CL	3-4-5	"	2	"	1.5	3.0	48
				4-10-12	"	3	"	3.0	4.5	40
				14-14-15	"	4	"	4.5	6.0	45
1.5	3.0	Silt, fine sandy with clay, 35% shale fragments, dry, very stiff, gry to brn.	ML-CL	12-8-7	"	5	"	6.0	7.0	45
					Dia	6	HQW	7.0	10.0	88
					"	7	"	10.0	15.0	100
					"	8	"	15.0	23.0	88
3.0	4.7	Clay, silty & sandy, 15% shale fragments, moist, very stiff, gry.	CL		"	9	"	23.0	26.0	80
					"	10	"	26.0	31.0	100
					"	11	"	31.0	36.00	90
4.7	7.1	Silt, clayey & fine sandy, & clay shale partings in the sample which have iron stains on them. Very stiff, gry to black. Appears to be a saprolite of black carbonaceous shale.	ML-CL		"	12	"	36.0	40.0	100
					"	13	"	40.0	46.0	100
					"	14	"	46.0	52.0	100
7.1	9.4	Shale, gry to brn, med. bedded pieces of core, very wea. joints show water erosion & some of them are clay filled. Iron stains on core, calcareous, very soft, (Hardness 1), Lower Member, Waynesburg Formation, Dunkard Group.								
9.3	13.0	Limestone, silty & clayey, med. bedded to thin bedded, joint - 1"- 3", some open & wea., others joints are clay filled, soft (hardness 2), gry to brn.								
13.0	18.0	Gry silty sandstone with gry shale partings, limy, mod. hard (hardness 4), med. bedded, mod. broken.								
18.0	19.0	Gry sandy shale with sandstone lenses around 18.0' & a few clay seams, mod. soft (hardness 3), slightly wea.								
19.0	23.0	Gry clay shale, slightly broken with clay seams & vertical joints, core is in med. bedded pieces & is slightly wea.								
23.0	27.0	Gry silty & clayey limestone with clay filled & wea. seams, shaly zones, slightly wea., mod. soft (hardness 3), broken.								
27.0	30.5	Gry, limy, clay shale with limestone concretions, slightly wea., med. bedded core pieces, mod. broken with some vertical jointing, clay filled seams, mod. soft (hardness 3).								
30.5	42.9	Gry silty limestone, very slightly wea., med. bedded, slightly broken, mod. hard (hardness 4), with shaley clay seams.								
42.9	43.4	Gry shaley clay, soft, (hardness 2), (A seam)								
43.4	45.9	Gry calcareous sandstone, mod. hard (hardness 4), mod. broken, few iron stains on joints, fresh, fine to mod. grained, joints are slightly open with some staining on the joints.								
45.9	46.5	Gry clay shale, fresh, med. bedded core pieces, mod. soft (hardness 3), some limy seams & clay zones, slightly broken becoming unbroken & massive with one piece of core is about 3.0'. Joints fit together well, few sandstone interbeds.								
46.5	46.8	Black carbonaceous shale, mod. broken pieces, unwea., (hardness 3), unbroken (moderately soft).								
46.8	47.3	Waynesburg coal, upper bench (15"), strong cleating, fresh, little breakage, med. bedded, mod. soft (hardness 3).								
47.3	48.4	Gry clayey shale, also black shale, 1 piece of core, mod. soft, (hardness 3), unbroken.								
48.4	1.7	Waynesburg coal, Lower bench, strong cleating but little breakage, med. bedded (43"), mod. soft (hardness 3), fresh.								
51.4	52.0	Black carbonaceous shale, mod. soft (hardness 3), slightly broken, med. bedded core pieces fresh. Lower member, Waynesburg Formation, Dunkard Group - Base of Dunkard Group.								
52.0		End of boring. WL (7/21/70) 32.5'. WL (7/22/70) 34.5'.								

DH-3, ELEV. 863.1, 3+80, Centerline
Logged by: T. A. Bumper 7/23/70
Drilling Equipment: Joy Skid Rig

Hole From	Depth To	Description of Materials	Unif. Soil Class Symb.	STANDARD PENETRATION Blows per 6"	Type Bit Used	No.	Type	SAMPLES From Ft.	To Ft.	% Rec.
0.0	0.5	Topsoil, roots.		1-2-2	SpT	1	Jar	0.0	1.5	75
0.5	4.5	Clay, silty & sandy, 20% shale sand, moist, soft to med., yellowish gry.	CL	2-3-4	"	2	"	1.5	3.0	95
				4-4-5	"	3	"	3.0	4.5	85
				4-5-6	"	4	"	4.5	6.0	85
				7-12-40	"	5	"	6.0	7.5	80

DH-3 (Continued)

Hole From	Depth To	Description of Materials	Unif. Soil Class Symb.	Type Bit Used	No.	Type	SAMPLES From Ft.	To Ft.	% Rec.
4.5	7.0	Sand, clayey, with a few gravel from wea. durable shale, moist, stiff, yellow brn, saprolite from wea. shale.	SC	Dia	6	HQW	7.5	10.5	88
				"	7	"	10.5	15.5	100
				"	8	"	15.5	20.5	100
7.0	8.5	Wea. coal, black, soft (hardness 2), upper bench, Waynesburg coal, some clay seams.		"	9	"	20.5	25.5	100
				"	10	"	25.5	30.5	70
8.5	10.3	Clay, shaly, wea. gry to black, slightly broken, mod. bedded pieces of core, soft (hardness 2).		"	11	"	30.5	40.0	100
				"	12	"	40.0	50.0	100
10.3	12.5	Waynesburg Coal, lower bench, cleated & fractured, slightly wea., small pieces of core & slices, soft (hardness 2).							
12.5	13.0	Black shale, broken, soft (hardness 2) wea., thin bedded core, core pieces, Lower member, Waynesburg Formation, Dunkard Group.							
13.0	15.0	Sandy shale with interbedded fine grained gry sandstone, slightly wea., few clay seams, core fits well together with clay filled joints, small joints, mod. bedded, Uniontown Formation, Monongahela Group.							
15.0	21.4	Gry clay shale, slightly broken on a few seams but not wea., few clay seams, mod. bedded core pieces, mod. soft to soft (hardness 2+).							
21.4	23.4	Gry silty sandstone with interbedded shale, mod. hard (hardness 4) slightly limy, few broken seams in shale.							
23.4	25.5	Gry clay shale, fresh, mod. soft (hardness 3), mod. bedded pieces of core.							
25.5	26.5	Gry silty limestone, some shale partings, pyrite on some seams, mod. bedded, mod. hard (hardness 4).							
26.5	27.5	Gry clay shale, mod. bedded pieces, fresh, moderately soft, (hardness - 3)							
27.5	28.8	Dark gry silty limestone, mod. to thick bedded, slightly broken, mod. hard (hardness - 4), becoming light gry.							
28.8	31.2	Gry clay shale with concretions, soft (hardness 2), mod. bedded core pieces, fresh, few broken joints.							
31.2	35.0	Gry sandy limestone, few wea. seams, some have clay fill moderately broken, eroded seams have clay fillings, mod. hard (hardness - 4).							
35.0	38.5	Gry fine grained limestone, (micrite), few black shale interbeds, mod. hard, fresh, mod. bedded.							
38.5	44.7	Gry silty limestone with clay seams, broken along clay seams, mod. bedded, some wea., mod. hard (hardness - 4).							
44.7	55.7	Gry fine grained sandstone, mod. bedded, open joints limy in part, few limestone concretions, becomes thick bedded at base, mod. hard.							
55.7	59.0	Gry clay shale, mod. bedded pieces of core, mod. soft (hardness 3), slightly broken, few sandy zones & clay seams, Uniontown Formation, Monongahela Group.							
59.0		Bottom of hole. WL (7/23/70) 12.9', end of drilling, WL (7/24/70) 14.5', 24 hrs. WL (7/29/70) 14.2', stable.							

DH-4, ELEV. 849.1, 4+85, Centerline
Logged by: T. A. Bumper & A. L. Miller 7/9/70
Drilling Equipment: CME truck mounted, Rig 1

Hole From	Depth To	Description of Materials	Unif. Soil Class Symb.	STANDARD PENETRATION Blows per 6"	Type Bit Used	No.	Type	SAMPLES From Ft.	To Ft.	% Rec.
0.0	0.5	Topsoil		2-3-4	SpT	1	Jar	0.0	1.5	45
0.5	4.1	Silt, fine sand 30%, 5" coarse sand, trace of clay, moist, med. to stiff, brn.	ML-CL	3-4-5	"	2	"	1.5	3.0	45
				3-4-11	"	3	"	3.0	4.5	80
				13-11-10	"	4	"	4.5	6.0	80
4.1	11.0	Gravel & sand, slightly silty & clayey, less the 10% low plastic fines, cleaner toward bottom, wet, fine, brn to gry, all sizes of sand & gravel, perm test run, trace of coal from 7.5 - 10.0, a zone of soft brn clay at the base of zone.	GW-GC	11-10-9	"	5	"	6.0	7.5	40
				5-5-4	"	6	"	7.5	9.0	40
				4-3-2	"	7	"	9.0	10.5	25
				6-10-10	"	8	"	10.5	12.0	55
				24-82/0.4	"	9	"	12.0	12.9	90
					Dia	10	HQW	12.9	15.9	78
					"	11	"	15.9	22.5	60
					"	12	"	22.5	26.7	70
					"	13	"	26.7	32.5	70
11.0	12.3	Clay, sandy, moist, 30 - 40% non-durable sand size clay shale fragments, saprolite from clay shale, hard, gry.	CL		"	14	"	32.5	38.0	90
					"	15	"	38.0	40.0	85
					"	16	"	40.0	48.5	100
12.3	14.9	Wea. gry shale, breaks into pieces in core or spoon, slightly moist, soft (hardness 2), clay filled fractures & seams of gry cla (CL), Uniontown Formation, Dunkard Group.								
14.9	15.4	Coal.								
15.4	23.5	Gry fine grained limestone with some clay filled seams, seams show signs of erosion & also on joints, badly fract red & water eroded with iron staining on joints & seams, med. bedded, some open joints, mod. soft (hardness 3).								
23.5	27.5	Gry silty limestone, thin bedded, very broken with clay filled seams, med. gry color, mod. soft (hardness 3), cores comes out of barrel in small gravel & sand size pieces, some clay seams, wea.								
27.5	28.3	Silty limestone, clay seams, shaly partings, med. bedded, gry, mod. soft, slightly wea.								
28.3	42.8	Sandstone, micaceous, gry, med. bedded, fract red & broken with vertical joints & seams, some clay fillings above 30.7', core pieces 8' 10", fit together well below 30', Some vertical fract res, pyrite cubes & flakes of magnetite along seams in the core, fract res & joints are open to 1/8", mod. soft to mod. hard (hardness 3 - 4).								
42.8	47.7	Med. gry sandy shale, med. bedded core pieces, fit well together, few limy sections, mod. soft (hardness 3), clay seam 47.0 47.1', fresh.								
47.7	49.2	Dark gry shale, clayey, clean seams, thin bedded core pieces, becomes bituminous & black at 49', soft, mod. broken, equivalent at base to Uniontown coal. Uniontown Formation, Monongahela Group.								
49.2	49.5	Gry limestone with coal streaks, mod. soft to mod. hard, (hardness 3 - 4), 1 piece of core, fresh. Pittsburgh Formation, Monongahela Group.								
49.5		Bottom of hole. WL (7/13/70) 7.2', stable.								

DH-5, ELEV. 851.1, 3+80, Centerline
Logged by: T. A. Bumper 7/8/70
Drilling Equipment: CME truck Rig #1

Hole From	Depth To	Description of Materials	Unif. Soil Class Symb.	STANDARD PENETRATION Blows per 6"	Type Bit Used	No.	Type	SAMPLES From Ft.	To Ft.	% Rec.
0.0	0.5	Topsoil, roots up to 5" diameter, few sandstone flags to 1.5' diameter.		3-3-5	SpT	1	Jar	0.0	1.5	55
				4-4-4	"	2	"	1.5	3.0	20
0.5	3.0	Silt, clayey with 10 - 20% fine to medium sand, mod. density, slightly moist, brn.	ML-CL	1-8-8	"	3	"	3.0	4.5	67
				6-8-9	"	4	"	4.5	6.0	67
				4-4-5	"	5	"	6.0	7.5	60
				6-10-6	"	6	"	7.5	9.0	60
3.0	5.5	Fine sand, clayey, with 40% med. plastic fines, 10% coarse sand, moist, very stiff, brn.	SC	8-10-12	"	7	"	9.0	10.5	60
				8-10-12	"	8	"	10.5	12.0	50
				11-12-12	"	9	"	12.0	13.5	50
				28-34-34	"	10	"	13.5	14.4	80
5.5	12.2	Sand & gravel, silty 10 - 20% low plastic fines. Coarse	SC-GW	20-80/0.4	Dia	11	HQW	14.4	17.4	100
					"	12	"	17.4	22.4	40

	Unif. Soil Class Symb.	Type Bit Used	No.	Type	Samples From Ft.	To Ft.	% Rec.
... from non-	SC	Dia	6	NXM	7.5	10.5	80
...llow brn.		"	7	"	10.5	15.5	100
		"	8	"	15.5	25.5	100
... 2), upper		"	9	"	25.5	35.5	100
...lay seams.		"	10	"	35.5	43.0	70
..., slightly		"	11	"	43.0	49.0	100
...ces, soft		"	12	"	49.0	59.0	100

...ciated & fractured, slightly wea., small pieces of core

...ness 2) wea., thin bedded core, core pieces, Lower Dunkard Group.

...fine grained gry sandstone, slightly wea., few clay seams, ...lay filled joints, small joints, med. bedded, Uniontown

... on a few seams but not wea., few clay seams, med. bed- ...soft (hardness 2+).

...bedded shale, mod. hard (hardness 4) slightly limy, few

...ft (hardness 3), med. bedded pieces of core.

... partings, pyrite on some seams, med. bedded, mod.

...ness, fresh, moderately soft, (hardness - 3) ..., to thick bedded, slightly broken, mod. hard (hardness -

...ms, soft (hardness 2), med. bedded core pieces, fresh,

... seams, some have clay fill moderately broken, eroded ..., hard (hardness - 4). ...micrite), few black shale interbeds, mod. hard, fresh,

... seams, broken along clay seams, med. bedded, some wea.,

...d, bedded, open joints limy in part, few limestone con- ...d at base, mod. hard.

...ieces of core, mod. soft (hardness 3), slightly broken, ... Uniontown Formation, Monongahela Group.

... 12.9', end of drilling. WL (7/24/70) 14.[illegible]', 24 hrs. ... 14.2', stable.

7/9/70

	Unif. Soil Class Symb.	Standard Penetration Blows per 6"	Type Bit Used	No.	Type	Samples From Ft.	To Ft.	% Rec.
		2-3-4	SpT	1	Jar	0.0	1.5	45
...ne	ML-CL	3-4-5	"	2	"	1.5	3.0	45
...d.		3-6-11	"	3	"	3.0	4.5	80
		13-11-10	"	4	"	4.5	6.0	80
... &	GW-GC	11-10-9	"	5	"	6.0	7.5	40
...ost-		5-5-4	"	6	"	7.5	9.0	40
...on,		3-3-2	"	7	"	9.0	10.5	25
...isse		5-18-19	"	8	"	10.5	12.0	55
...on.		24-82/0.4	"	9	"	12.0	12.9	90
...9, a			Dia	10	NXM	12.9	15.9	78
... beer			"	11	"	15.9	22.5	60
			"	12	"	22.5	26.7	70
... non-	CL		"	13	"	26.7	27.5	70
			"	14	"	27.5	30.0	90
...y			"	15	"	30.0	40.0	85
			"	16	"	40.0	49.5	100

...piec-

... moist, soft (hardness 2), clay filled fractures & seams ...Formation, Dunkard Group.

...ith some clay filled seams, seams show signs of erosion & ...ed & water eroded with iron staining on joints & seams. ..., mod. soft (hardness 3).

...dded, very broken with clay filled seams, med. gry color, ... comes out of barrel in small gravel & sand size pieces,

... shaly partings, med. bedded, gry, mod. soft, slightly wea. ...d. bedded, fractured & broken with vertical joints & seams, ...", core pieces 8" 10", fit together well below 30", Some ...ches & flakes of magnetite along seams in the core, ...to 1/8", mod. soft to mod. hard (hardness 3 - 4).

...bedded core pieces, fit well together, few limy sections, ... from 4[illegible].8 47.1', fresh.

... seams, thin bedded core pieces, becomes bituminous & ...en, equivalent at base to Uniontown coal. Uniontown

...ks, mod. soft to mod. hard, (hardness 3 - 4), 1 piece ...Formation, Monongahela Group. ... 7.2', stable.

	Unif. Soil Class Symb.	Standard Penetration Blows per 6"	Type Bit Used	No.	Type	Samples From Ft.	To Ft.	% Rec.
		3-3-5	SpT	1	Jar	0.0	1.5	55
		4-4-4	"	2	"	1.5	3.0	20
		1-8-8	"	3	"	3.0	4.5	67
	ML-CL	6-8-9	"	4	"	4.5	6.0	67
		4-6-[illegible]	"	5	"	6.0	7.5	40
		8-10-[illegible]	"	6	"	7.5	9.0	60
	SC	8-10-12	"	7	"	9.0	10.5	60
		11-12-12	"	8	"	10.5	12.0	50
		28-34-35	"	9	"	12.0	13.5	55
	GC-GW	20-80/0.4	"	10	"	13.5	14.4	80
			Dia	11	NXM	14.4	17.4	100
			"	12	"	17.4	22.4	90

BH-5 (Continued)

Hole Depth From	To	Description of Materials	Unif. Soil Class Symb.	Type Bit Used	No.	Type	Samples From Ft.	To Ft.	% Rec.
		fraction is formed of sub-angular to sub-rounded sandstone & shale, wet, med. density, brn.		Dia	13	NXM	22.4	31.1	100
				"	14	"	31.1	40.7	100
				"	15	"	40.7	50.8	100
12.8	14.0	Clay, sandy & gravelly, a saprolite of wea. gry shale, coarse fraction forms 30 - 40% of sample, hard, moist, gry.	CL						
14.0	15.3	Wea. clay shale, Gry, breaks up in sampler into small pieces which may be dented with fingers, clay seams & small hair size vertical fractures, Uniontown Formation, Monongahela Group.							
15.3	20.9	Gry fine - grained limestone (micrite), hardness 4. Med. hard, bedding joints to 1', med. bedded, clay in bedding & diagonal joints, bedding joints are 3 - 8" below 17.0' & joints or seams may be open to ½", clay zones along joints & seams & there is evidence of water movement on joints. Clay seam from 18.0 - 19.2. Circulating water lost in this bed, regained, & then lost again.							
20.9	23.6	Silty limestone, med. gry, hardness 3, med. bedded, fractured & jointed, some fracturing, clay seams from 22.0 - 22.4, few thin, vertical water eroded seams.							
23.6	26.4	Med. gry, limy clay shale, med. bedded up to 1.0' between bedding joints, wea. & clay filled seams, vuggy, hardness 4.							
26.4	27.5	Med. gry, fine grained, silty limestone, fractured. Some water eroded joints & seams, hardness 4.							
27.5	41.4	Med. gry sandstone, fine grained, thin to thick bedded, occasionally limy, micaceous, more than 60% of bedding joints are more than 12", hardness 4.							
41.4	45.3	Med. gry shale, core broken into med. bedded pieces to 44.0' & then is very broken, hardness 2.							
45.3	47.6	Dark gry shale with clay seams, med. bedded core pieces to very broken along clay seams, hardness 2, Uniontown Coal, Uniontown Formation, Monongahela Group.							
47.[illegible]	48.7	Silty limestone, med. gry, with clay seams, med. bedded, mod. broken. Pittsburgh Formation, Monongahela Group.							
48.7	49.[illegible]	Gry shaly clay, some shale parting, hardness 1.							
49.[illegible]	50.8	Gry limestone with shale partings, hardness 3, med. bedded, some eroded bedding joints with clay seams. Pittsburgh Formation, Monongahela Group.							
50.8		Bottom of hole. WL (7/9/70) 7.1', 1000 hrs. WL (7/10/70) 6.0', 1335 hrs. WL (7/13/70) 9.0'.							

BH-6, ELEV. 858.8, 6+80, Centerline
Logged by: T. A. Dumper 7/13/70
Drilling Equipment: CME Truck Mounted, Rig #1

Hole Depth From	To	Description of Materials	Unif. Soil Class Symb.	Standard Penetration B Blows per 6"	Type Bit Used	No.	Type	Samples From Ft.	To Ft.	% Rec.
0.0	0.5	Topsoil, shale chips, roots		2-5-6	SpT	1	Jar	0.0	1.5	85
0.5	1.5	Clay, silty & sandy with a few shale gravels, 30% fine to coarse sand, moist, stiff, yellow brn (colluvial)	CL	6-7-10	"	2	"	1.5	3.0	60
				6-6-10	"	3	"	3.0	4.5	60
				6-8-11	"	4	"	4.5	6.0	67
				10-9-13	"	5	"	6.0	7.5	85
1.5	5.5	Clay, silty with 20% fine to coarse sand, coal & shale fragments below 4.1', very stiff, moist, dark to med. brn. Drilling water doesn't leak from hole. (Colluvial)	CL	10-11-14		6	"	7.5	9.0	15
				2-5-6	"	7	"	9.0	10.5	100
				5-13-16	"	8	"	10.5	12.0	85
				10-8-11	"	9	"	12.5	14.0	85
				13-5-12	"	10	"	14.0	15.5	40
				2-4-10	"	11	"	15.5	17.0	33
				6-7-9	"	12	"	17.0	18.5	40
5.5	[illegible].0	Clay, sandy, 30 - 40% shale gravel (non-durable), moist, stiff, gry to yellowish gry.	CL	21-50	"	13	"	18.5	19.5	60
						14	cased to		20.5	0
					Dia	15	NXM	20.5	2[illegible].0	87
					"	16	"	2[illegible].0	35.6	100
[illegible].0	9.0	As above 1.5 - 5.5, stiff to very stiff.	CL		"	17	"	3[illegible]	45.2	100
					"	18	"	45.2	50.0	100
9.0	11.5	Clay, fine to med. sand with 10% gravel, 25% sand, moist, stiff, brn. (alluvium)	CL							
11.[illegible]	19.2	Gravel, sandy & silty. 30% fine to coarse sand, 10 - 20% low plastic fines, moist, firm, brn to gry, coarse fraction includes sandstone, shale, & coal.	GC-GW							
19.2	20.5	Wea. gry to brn shale, soft (hardness 1), very broken, Uniontown Formation, Monongahela Group.								
20.5	22.3	Med. to dark gry shale with clay seams, slightly fractured, slightly wea., soft (hardness - 2), core is in ½ - 1" pieces.								
22.3	24.0	Greyish brn silty limestone with clay shale partings. Thin bedded (2") with vertical jointing, slightly wea., (hardness 2 - 3) soft to mod. soft.								
24.0	24.8	Gry clay, soft to very soft (hardness 1 - 2), some shaly partings.								
24.8	26.[illegible]	Gry shale with clay seams, soft, (hardness 2), med. bedded core pieces, broken on joints near the clay seams. Fresh.								
26.7	36.7	Gry limestone with interbedded shale & some clay seams. Partly brecciated but healed into solid pieces of core. Med. bedded, shale zone from 31.0 - 31.[illegible] & clay seams to 3" thick 35.0. Slicken sides noted in core at 34.6.								
36.7	39.5	Medium gry shale with calcite & limestone concretions mod. soft to mod. hard (hardness 3 - 4), few clay seams near 37.0.								
39.5	50.0	Gry calcareous sandstone, thick bedded to med. bedded, some bituminous zones, finely cross bedded and micaceous, less calcareous toward bottom, becomes vertically fractured with open, pyrite deposited joints. Uniontown Formation. Monongahela Group.								
50.0		Bottom of hole. WL (7/1[illegible]/70) 13.1', WL (7/17/70) 12.4'.								

Note: All soil and rock classifications were determined by visual examination.

AS BUILT PLANS

WHELING CREEK WATERSHED
FLOODWATER RETARDING DAM PA-647
WASHINGTON COUNTY, PENNSYLVANIA
LOGS OF TEST HOLES
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

T. A. Dumper | 7-70

PA-647-P

PLATE 7

D'APPOLONIA

DRAWN BY | ACS | CHECKED BY | BE | 3/1/79
APPROVED BY | JMP | 3-1-79
DRAWING NUMBER 78-367-B44

DH-7, ELEV. 872.99, 7+40, Centerline
Logged by: T. A. Dumper & J. Van, A. L. Miller
Drilling Equipment: CME Skid Mounted, Rig #2

Hole Depth From	To	Description of Materials	Unif. Soil Class Symb.	STANDARD PENETRATION Blows per 6"	Type Bit Used	No.	Type	SAMPLES From Ft.	To Ft.	% Rec.
0.0	0.5	Topsoil, roots, cobbles, shrubs, some organic material.		3-5-7	SpT	1	Jar	0.0	1.5	80
				6-4-4	"	2	"	1.5	3.0	0
				3-9-18	"	3	Jar	3.0	4.5	90
0.5	3.5	Gravel, sandy & silty, 20% fines, loose, moist, brn.	GM	23-48-95	"	4	"	4.5	6.0	87
					Casing Drilling			6.0	7.5	
3.5	5.0	Gravel, clayey & sandy - coarse fraction breaks into a "CL soil" with finger pressure. The strata is a saprolite of non-durable wea. shale.	GC		Dia	5	NQTH	7.5	9.5	60
					"	6	"	9.5	14.0	100
					"	7	"	16.0	26.0	100
					"	8	"	26.0	36.0	100
					"	9	"	36.0	46.0	100
					"	10	"	46.0	56.0	100
5.0	10.0	Wea., gry, clay shale, soft, hardness 1, breaks into pieces along bedding joints with secondary fracturing & jointing, bedding joints 0.5 - 2.0', Lower Member, Waynesboro Formation, Dunkard Group.			"	11	"	58.0	60.0	100
10.0	12.2	Sandstone shaly, fine grained, porous streaks, hardness 2 - 2+, with thin shale partings, gry with tan streaks, thin to med. bedded pieces of core.								
12.2	17.1	Gry shale with brn streaks, wea., soft, hardness 1 - 2, clay layers 14.1 - 14.2' & 15.8 - 15.9'.								
17.1	18.7	Coal, soft, black with impurities, vertical fractures. Waynesburg Coal, Upper bench.								
18.7	19.7	Dark gry shale, very soft to soft, hardness 1 - 2, thin bedded.								
19.7	20.7	Dark gry to black carbonaceous shale, slightly silty.								
20.7	21.5	Coal, black, very soft, hardness 1, with vertical fractures & impurities - Lower Bench, Waynesburg Coal.								
21.5	21.9	Black carbonaceous shale - to dark gry, very soft to soft, hardness 1 - 2, Lower Member, Waynesburg Formation, Dunkard Group.								
21.9	27.5	Gry silty & sandy shale, soft to mod. soft, hardness 2 +3, med. bedded pieces of core. Uniontown Formation, Monongahela Group.								
27.5	32.4	Gry, fine grained sandstone, mod. soft, hardness 3, slightly calcareous, shaly zones with bituminous or shale partings, micaceous & pyrite. dense.								
32.4	42.8	Gry clayey shale, soft, hardness 2, vertical fractures & broken at 41.8.								
42.8	47.5	Limestone with interbedded shale, limestone is finely crystalline & dense, gry to greyish tan, mod. soft, hardness 3, shale - soft, hardness 2, med. bedded joints show signs of water erosion.								
47.5	53.	Gry calcareous shale, fossils, wea. joints, limestone concreations, hardness 3 - 4, dense.								
53.7	60.0	Fine grained sandstone, gry, med. bedded, slightly wea. joints, some shale streaks, Uniontown Formation, Monongahela Group.								
60.0		Bottom of hole. WL (7/7/70) 13.1, dL (7/9/70) 13.5 dL (7/10/70) 12.5, WL (7/14/70) 11.0								

DH-8, ELEV. 915, , 8+00.7, Centerline
Logged by: T. A. Dumper 7/21/70
Drilling Equipment: CME Truck Mounted, Rig #1

Hole Depth From	To	Description of Materials	Unif. Soil Class Symb.	STANDARD PENETRATIONS Blows per 6"	Type Bit Used	No.	Type	SAMPLES From Ft.	To Ft.	% Rec.
0.0	1.3	Gravel & sand, silty, moist, firm, brn road bed.	GM	6-16-9	SpT	1	Jar	0.0	1.5	40
				6-10-15	"	2	"	1.5	3.0	40
1.3	5.8	Silt, sandy & gravelly, 10% fine gravel, 30% non-durable, fine to coarse sand, very stiff, moist, brn.	ML	9-8-9	"	3	"	3.0	4.5	10
				10-10-12	"	4	"	4.5	6.0	25
				4-4-2	"	5	"	6.0	7.5	75
				8-19-36	"	6	"	7.5	9.0	25
				9-30-70	"	7	"	9.0	10.0	40
5.8	7.8	Clay, sandy (30 - 40% non-durable shale, sandy, a few sandstone gravel). Very stiff, moist, brn. Saprolite of wea. sandstone & shale.	CL		Dia	8	NQTH	10.0	14.0	85
					"	9	"	14.0	21.5	100
					"	10	"	21.5	28.0	100
					"	11	"	28.0	38.0	100
					"	12	"	38.0	47.6	100
					"	13	"	47.6	57.0	100
7.8	13.0	Wea. shale, very soft but becoming harder with depth (hardness 1), very broken to broken clay seams from 10.0 - 12.0 & a calcite seam from 12.5 - 13.0. Iron stained joints & seams, few sandy areas Lower Member, Waynesburg Formation, Dunkard Group.			"	14	"	57.0	66.0	100
					"	15	"	66.0	76.0	100
					"	16	"	76.0	86.0	91
					"	17	"	86.0	94.5	100
13.0	14.3	Brownish gry silty sandstone with shale partings, thin to med. bedded, mod. soft (hardness 3), slight to mod. wea.								
14.3	18.0	Gry clay shale, soft (hardness 2), mod. wea., thin to med. bedded core pieces. Clay filled joints & seams & some iron staining on bedding joints & seams, few limestone concreations. Some vertical jointing.								
18.0	19.0	Silty clay with shaly partings, med. bedded, soft, (hardness 1 - 2) brownish gry.								
19.0	20.5	Brownish gry shale, soft, slightly wea. (hardness 2) clay filled seams, mod. bedded pieces, mod to very broken, limy.								
20.5	23.8	Gry clay shale with clay seams, soft (hardness 2), looks like a med. gry fire clay, very broken.								
23.8	24.1	Black, impure coal, soft, broken.								
24.1	24.8	As above from 20.5 - 23.8.								
24.8	27.0	Gry clay shale, mod. bedded core pieces, slightly broken and wea., mod. hard (hardness 4).								
27.0	31.0	Gry shale with clay seams, soft, (hardness 2) slightly broken, med. bedded core pieces, some vertical jointing, iron stains on some of the seams & joints.								
31.0	34.0	Gry micaceous & calcareous sandstone with shale partings, jointed vertically with iron stains on joints, med. to thickbedded, mod. hard (hardness 4), very slightly wea.								
34.0	43.5	Gry shale with 4" clay seams, mod. bedded core pieces some of which are slightly broken, fresh, some limy zones soft to mod. soft. (hardness 2 - 3)								
43.5	45.8	Gry silty sandstone with shaly partings, med. to thick bedded, fresh, slightly bedrn, mod. hard (hardness 4).								
45.8	48.	Gry shale, very slightly broken, thickbedded core pieces, mod. soft (hardness 3), to soft (2).								
48.	50.0	Gry sandy shale with interbedded gry silty, shaly sandstone, med. bedded, mod soft (hardness 3), slightly broken in shale zones.								
50.	51.0	Black carbonaceous shale, unbroken, fresh, mod. soft, (hardness 3).								
51.0	52.3	Black coal, mod. broken with strong cleating, mod. soft, 16" thick, upper bench, Waynesburg Coal.								
52.3	53.8	Med. to dark gry shale, mod. bedded pieces, fresh, mod. broken, mod. soft (hardness 3).								
53.8	54.1	Black carbonaceous shale, fresh, unbroken, mod. soft (hardness 2).								
54.1	56.8	Black coal, 28" thick, strongly cleated, marcasite on cleats, mod. soft (hardness 3), Lower bench, Waynesburg Coal.								
56.8	57.2	Black shale, slightly broken, mod. soft, core on mod. bedded pieces (hardness 3),								

DH-8 Continued

Hole Depth From	To	Description of Materials
		Lower member, Waynesburg Formation, Dunkard Group.
57.2	65.8	Gry, micaceous sandstone, mod - thickbedded, calcareous cement, fresh, unbroken, moderately hard (hardness 4), Uniontown Formation, Monongahela Group.
65.8	76.2	Dark Gry shale, mod. soft (hardness 3), mod. bedded pieces of core up to 1.0', joints fit together well. Shaly clay seams from 72.4 & because calcareous below 70.0'. Fresh although there are clay seams from 74.0 - 74.2 & 74.0 - 75.3.
76.2	79.0	Gry limestone, mod. bedded, shaly seams and bedding joints, fresh, mod. hard (hardness 4).
79.0	79.4	Gry to black shale & shaly clay, mod. broken, thin bedded core pieces, mod. soft, (hardness 3), fresh.
79.4	81.0	Gry limestone, mod. bedded, slightly broken with diagonal joints, mod. hard (hardness 3/4), fresh.
81.0	82.0	Med. to dark gry silty limestone, mod. bedded, slightly broken, mod. hard (hardness 4), fresh.
82.0	84.0	Gry limestone conglomerate, small limestone gravels in a silty limestone matrix, dark gry, mod. hard (hardness 4), mod. bedded, mod. broken, some black & gry shale clasts.
84.0	86.8	Med. gry silty limestone, mod. broken, mod. bedded, some shaly partings, few shaly clay joint fillings, fresh, mod. soft, (hardness 3).
86.8	91.5	Gry shale, slightly broken in upper jointed clay films, some limestone concreations, thick bedded to mod. bedded, mod. soft, (hardness 3).
91.5	94.5	Gry sandstone, shaly in part, fine to mod. grained, massive, 1 piece of core 18" long, some limy zones, mod. hard (hardness 4), fresh, Uniontown Formation, Monongahela Group.
94.5		Bottom of hole. WL (7/22/70) 10.2', 0915 hours, stable.

DH-9, ELEV. 902.2, 8+00, 100' D.S.
Logged by: T. A. Dumper 7/20/70
Drilling Equipment: CME Truck Mounted Rig #1

Hole Depth From	To	Description of Materials	Unif. Soil Class Symb.	STANDARD PENETRATION Blows per 6"	Type Bit Used	No.	Type	SAMPLES From Ft.	To Ft.	% Rec.
0.0	0.4	Clay, sandy & silty with a few gravel, dry, mod. brn.	ML-CL	4-6-13	SpT	1	Jar	0.0	1.5	55
				Calcarge hole & case	"			1.5	2.0	-
					Dia	2	NQTH	2.0	12.0	85
0.4	2.0	Wea. sandstone, very broken, mod. soft, hardness 3, brn, breaks into pieces in in spoon, Lower Member, Waynesburg Formation, Dunkard Group.			"	3	"	12.0	19.6	100
					"	4	"	19.6	29.6	100
					"	5	"	29.6	37.5	100
					"	6	"	37.5	40.0	90
2.0	4.7	Gry calcareous sandstone with brn iron stained zone, especially on joints & seams, mod. wea., mod. hard (hardness 4).								
4.7	10.0	Olive colored clay shale with iron stained joints & clay seams, very broken, thin bedded core pieces, soft (hardness 2), very wea. & partly decomposed.								
10.0	14.0	Yellow brn to gry sandy shale, fractured & very broken, few clay seams, mod. soft (hardness 3), vertical fractures & joints in core, joints open 1/16", the zone seams very permeable & drilling water is not all returned to the surface. Partly wea. & decomposed.								
14.0	16.0	Gry clay shale to yellow brn, partly wea., partly to very broken, contains clay filled seams up to 1" thick, thin bedded core pieces, soft to mod. soft (hardness 2+).								
16.0	17.5	Gry limestone with iron stained calcite seams, fractured & broken & the seams have been repaired with the calcite, mod. wea., some clay seams, thin to mod. bedding, mod. soft (hardness 3).								
17.5	21.8	Gry limy shale with clay seams, mod. to slightly wea., very broken & fractured, breaks down into a shaly clay (CL) in barrel, soft (hardness 2).								
21.8	27.6	Gry clay shale, very slightly wea., slightly broken, mod. bedded, mod. soft to soft (hardness 2 - 3).								
27.6	30.9	Gry calcareous sandstone, mod. bedded, mod. soft to mod. hard (hardness 3 - 4), silty with some shale partings mod. grained sandstone, fresh.								
30.9	40.0	Gry clay shale, unwea., some breakage at bedding joints but generally unbroken with a few thin clay seams, mod. bedded, few sandy & limy areas, Lower member, Waynesburg Formation, Dunkard Group.								
40.0		Bottom of hole. WL (7/20/70) 11.0'. WL (7/22/70) 20.8'.								

DH-10, ELEV. 906.8, 8+10, 209.5' D.S.
Logged by: A. L. Miller & T. A. Dumper 8/4/70
Drilling Equipment: Joy Track Mounted

Hole Depth From	To	Description of Materials	Unif. Soil Class Symb.	STANDARD PENETRATION Blows per 6"	Type Bit Used	No.	Type	SAMPLES From Ft.	To Ft.	% Rec.
0.0	0.3	Topsoil		2-6-4	SpT	1	Jar	0.0	1.5	66
0.3	3.0	Clay, silty & sandy, 10% coarse sand & gravel, moist, stiff, brn.	CL	3-4-5	"	2	"	1.5	3.0	54
				6-9-18	"	3	"	3.0	4.5	100
				36-40-25	"	4	"	4.5	6.0	74
3.0	6.0	Clay, silty & sandy, 20 - 30% shale, sand, moist, very stiff, brn to gry, shale saprolite, becomes hard with depth.	CL	8.5/62	"	5	"	6.0	6.5	60
					Dia	6	NQTH	6.5	11.0	84
					"	7	"	11.0	17.0	100
					"	8	"	17.0	22.0	100
					"	9	"	22.0	30.5	100
6.0	6.7	Wea. brn shale, very broken, soft - mod. soft, (hardness 2 - 3), clay seams, Lower Member, Waynesburg Formation, Dunkard Group.			"	10	"	30.5	40.0	100
6.7	12.2	Gry shaly sandstone, wea. brn, clay seams in clayey sandstone sections, mod. soft when wea. to mod. hard when fresh (hardness 3 - 4), limy, mod. broken.								
12.2	14.7	Wea., brn. clay shale, iron stained seams with clay filling & vertical joints & fractures, very broken, soft, (hardness 2).								
14.7	25.5	Gry clay shale with limestone concreations, slightly wea. to mod. wea. on some seams, mod. broken, mod. bedded pieces of core & some clay seams, mod. soft (hardness 3).								
25.5	27.5	Limestone & interbedded shale with clay seams, gry, limestone is mod. bedded & wea., & mod. hard (hardness 4), shale is broken, wea. on seams & is mod. soft (hardness 3).								
27.5	34.3	Gry clay shale with clay seams, eroded on joints, mod. broken to slightly broken below 31.0, thin to mod. bedded pieces of core, mod. soft (hardness 3).								
34.3	38.0	Gry, limy & shaly sandstone, mod. bedded, mod. wea., slightly broken, iron stained seams & joints few of which are clay filled, mod. hard (hardness 4).								
38.0	40.0	Gry. clay shale with broken clay filled seams, fresh, mod. bedded pieces of core, mod. soft (hardness 3), Lower member, Waynesburg Formation, Dunkard Group.								
40.0		Bottom of hole. dL (8/5/70) 14.2', WL (8/4/70) 11.3'								

...ion, Dunkard Group.
... thickbedded, calcareous cement, fresh, unbroken,
...intown Formation, Monongahela Group.
...ium to, med. bedded pieces of core up to 1.0',
... clay seams from 72.9 & becomes calcareous below
... clay seams from 74.0 - 74.2 & 74.0 - 75.3.
...y seams and bedding joints, fresh, med. hard

..., med. broken, thin bedded core pieces, med. soft,

...ghtly broken with diagonal joints, med. hard

..., med. bedded, slightly broken, med. hard (hard-

...ll limestone gravels in a silty limestone matrix,
..., med. bedded, med. broken, some black & gry shale

...wnish, med. bedded, some shaly partings, few
..., med. soft, (hardness 3).
...ular jointed clay films, some limestone concretions,
... soft, (hardness 4).
...ium to med. grained, massive, 1 piece of core 10"
... (hardness 4), fresh, Pittsburgh Formation,

...0.2', 091% humus, stable.

...AL

...	STANDARD PENETRATION			SAMPLES		
...	Blows per 6"	Type Bit Used	No.	Type	From Ft.	To Ft.	% Rec.
ML	3-6-13	SpT	1	Jar	0.0	1.5	55
	Enlarge hole & case				1.5	2.0	-
		Dia	2	NQH	2.0	12.0	85
		"	3	"	12.0	19.6	100
		"	4	"	19.6	29.6	100
		"	5	"	29.6	37.5	100
		"	6	"	37.5	48.0	90

...iron stained zone, especially on joints & seams,
...ng.
...stained joints & clay seams, very broken, thin
... 3), very wea. & partly decomposed.
...tured & very broken, few clay seams, med. soft
... & joints in core, joints open 1/16", the zone
... water is not all returned to the surface. Partly

...rtly wea., partly to very broken, containe clay
...bedded core pieces, soft to med. soft (hardness

...calcite seams, fractured & broken & the seams have
... med. wea., some clay seams, thin to med. bedding,

... med. to slightly wea., very broken & fractured,
...) in barrel, soft (hardness 2).
...m., slightly broken, med. bedded, med. soft to

... bedding, med. soft to med. hard (hardness 3 - 4),
... med. grained sandstone, fresh.
...hange at bedding joints but generally unbroken with
...ded, few sandy & limy seams, Lower member,
...roup.
...0'. WL (7/22/70) 20.0'.

.../70

...	STANDARD PENETRATION			SAMPLES		
...	Blows per 6"	Type Bit Used	No.	Type	From Ft.	To Ft.	% Rec.
	2-6-4	SpT	1	Jar	0.0	1.5	66
	3-4-5	"	2	"	1.5	3.0	54
	4-9-10	"	3	"	3.0	4.5	100
	34-40-25	"	4	"	4.5	6.0	74
	8.5/62	"	5	"	6.0	6.5	40
		Dia	6	NQH	6.5	11.0	86
		"	7	"	11.0	17.0	100
		"	8	"	17.0	22.0	100
		"	9	"	22.0	30.5	100
		"	10	"	30.5	40.0	100

...Dunkard Group.
... clay seams in clayey sandstone sections, med. soft
...ish (hardness 3 - 4), limy, med. broken,
...bedded seams with clay filling & vertical joints &
... (hardness 2).
...nerations, slightly wea. to med. wea., on some
... pieces of core & some clay seams, med. soft

...with clay seams, gry, limestone is med. bedded &
..., shale is broken, wea. on seams & is med. soft

..., eroded on joints, med. broken to slightly broken
... pieces of core, med. soft (hardness 3).
...med. bedded, med. wea., slightly broken, iron stained
... clay filled, med. hard (hardness 4).
...ay filled seams, fresh, med. bedded pieces of core,
...mmer, Waynesburg Formation, Dunkard Group.
...0.2'. WL (8/6/70) 11.3'

BH-11, ELEV. 851.1, 5+31, Centerline
Logged by: T. A. Draper 8/5/70
Drilling Equipment: CME Truck Mounted Rig #4

Hole From	Depth To	Description of Materials	Unified Soil Class Symb.	STANDARD PENETRATION Blows per 6"	Type Bit Used	No.	Type	SAMPLES From Ft.	To Ft.	% Rec.
0.0	4.0	Silt, fine sandy & clayey, trace of mud & coarse sand, 20 - 30% fine sand, moist, med. brn, mod to stiff, black shale chips, root hairs, alos (alluvium).	ML-CL	2-3-4	SpT	1	Jar	0.0	1.5	80
				7-6-7	"	2	"	1.5	3.0	67
				3-3-4	"	3	"	3.0	4.5	85
				3-3-3	"	4	"	4.5	6.0	73
				4-3-2	"	5	"	6.0	7.5	15
				2-3-2	"	6	"	7.5	9.0	67
4.0	5.5	Sand, silty & clayey, moist, loose to med., yellow brn, 30% med. plastic fines, 20% coarse sand, root is fine to med. sand. (alluvium).	SC	3-4-4	"	7	"	9.0	10.5	67
				7-11-11	"	8	"	10.5	12.0	45
				10-35-50/0.2	"	9	"	12.0	13.2	100
					Dia	10	NQH	13.2	15.0	95
5.5	11.0	Sand & gravel, silty & clayey, 10 - 30% med. plastic fines, moist to wet, loose, brn. Estimated gradation from spoon sample is 50% gravel, 30 - 40% fine - coarse sand. Coarse fraction is both sandstone & shale fragments ("creek gravel" - alluvium).	GC-GM		"	11	"	15.0	20.0	90
					"	12	"	20.0	25.0	95
					"	13	"	25.0	30.0	100
					"	14	"	30.0	35.0	100
					Dia	15	"	35.0	40.0	100
					"	16	"	40.0	47.5	99
					"	17	"	47.5	53.0	74
					"	18	"	53.0	55.0	100
					"	19	"	55.0	60.0	100
					"	20	"	60.0	65.0	99
					"	21	"	65.0	70.0	94
11.0	12.5	Sand, silty & clayey, firm, wet, gry. 30% med. plastic fines, sand is fine - coarse, multi-colored shale fragments.	SC		"	22	"	70.0	75.0	82
12.5	14.5	Gry, gry shale, soft (hardness 2)clay seams, med. broken, med. bedded to thin bedded pieces of core, Uniontown Formation, Monongahela Group.								
14.5	14.7	Gry, fine grained limestone with a few clay seams that are wea., med. bedded, med. broken to slightly broken, seams open 1/16" . A clay seam from 17.5 - 18.0'.								
14.7	22.3	Gry limestone conglomerate - pieces of micrite gry limestone in a gry limy shale matrix, med. broken, medium bedded core pieces, clay deposits on joints, mod. soft (hardness 3).								
22.3	24.5	Gry, limy clay shale with clay filled joints & seams, slightly wea., med. bedded core pieces that are mod. broken, mod. soft (hardness 3).								
24.5	25.0	Gry fine-grained limestone with interbedded shale, mod. wea., med. bedded pieces of core that are mod. broken, shale is mod. soft (hardness 3), limestone is mod. hard (hardness 4).								
25.0	27.1	Gry limy shale with limestone concretions, med. bedded pieces of core, clay seams, fresh, mod. soft (hardness 3).								
27.1	41.1	Gry, limy, shaly sandstone, clay & shale filled joints, med. to thick bedded pieces, iron stained seams, bedding joints up to 1.5' apart, voids at 40. - 35.0 & 35.0 - 35.9, lost circulation at 34.7, flecks of mica & pyrite, mod. hard (hardness 4).								
41.1	48.0	Gry clay shale with limestone concretions, few clay filled joints, few sandy zones to 0.1' thick, no concretions below 43.9' mod. soft (hardness 3), med. bedded core pieces, Uniontown formation, Monongahela formation.								
48.0	53.0	Gry silty limestone with shaly clay seams up to 0.1' thick, med. bedded, mod. hard (hardness 4), mod. broken, clay seams are very soft (hardness 1), fresh, Pittsburgh formation, Monongahela Group.								
53.0	58.5	Gry clay shale, mod. soft (3), med. bedded pieces of core that are mod. broken and very slightly wea.								
58.5	59.0	Gry silty limestone, with few clay seams, med. to thick bedded, mod. hard (hardness 4).								
59.0	61.0	Gry clay shale, mod. soft (hardness 3), med. bedded core pieces, slightly broken, fresh, some clay films on bedding joints.								
61.0	69.9	Gry, silty, fine grained limestone with some interbedded lime clay shale, med. bedded, slightly broken with diagonal joints, mod. hard (hardness 4).								
69.9	75.0	Gry clay shale, slightly limy with clay filled bedding joints, med. bedded pieces of core, fresh, mod. soft (hardness 3), Pittsburgh Formation, Monongahela Group.								
75.0		Bottom of hole. WL (8/7/70) 7.5'.								

TP-12, ELEV. 851.0, 5+35, 50' U.S. 8/26/70

Hole From	Depth To	Description of Materials	Class Symb.	No.	Type	From Ft.	To Ft.
0.0	3.3	Silt, clayey, 30% fine - coarse sand, moist, stiff, brn.	ML-CL	1	extra large Bag	0.0	0.5
3.3	4.5	Sand & gravel, silty & clayey, 10 - 20% med. plastic fines, few cobbles, mod. moist to wet, brn.	GM-GC	Sample for in place density			
4.5		Bottom of hole. (132.45 p.c.f.)					

TP-13, ELEV. 852.5, 5+75, 280' U.S. 8/26/70

Hole From	Depth To	Description of Materials	Class Symb.	No.	Type	From Ft.	To Ft.
0.0	2.0	Silt, fine sandy, 10 - 20% fine sand, moist, medium density, brn, alluvium.	ML	1	extra large Bag	0.0	0.5
2.0	4.4	Sandy, silty & clayey 20 - 40% low plastic fines, moist, med. brn, becomes cleaner with depth.	SM	Sample for in place density determination			
4.4	6.5	Sand & gravel, silty 10 - 20% low plastic fines, brn, becoming gry at 6.0 loose to med. density, becomes wet at 5.5'. (131.03 p.c.f.)	GM-GW				

AS BUILT PLANS

Note: All soil and rock classifications were determined by visual examination.

WHEELING CREEK WATERSHED
FLOODWATER RETARDING DAM PA-647
WASHINGTON COUNTY, PENNSYLVANIA
LOGS OF TEST HOLES
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

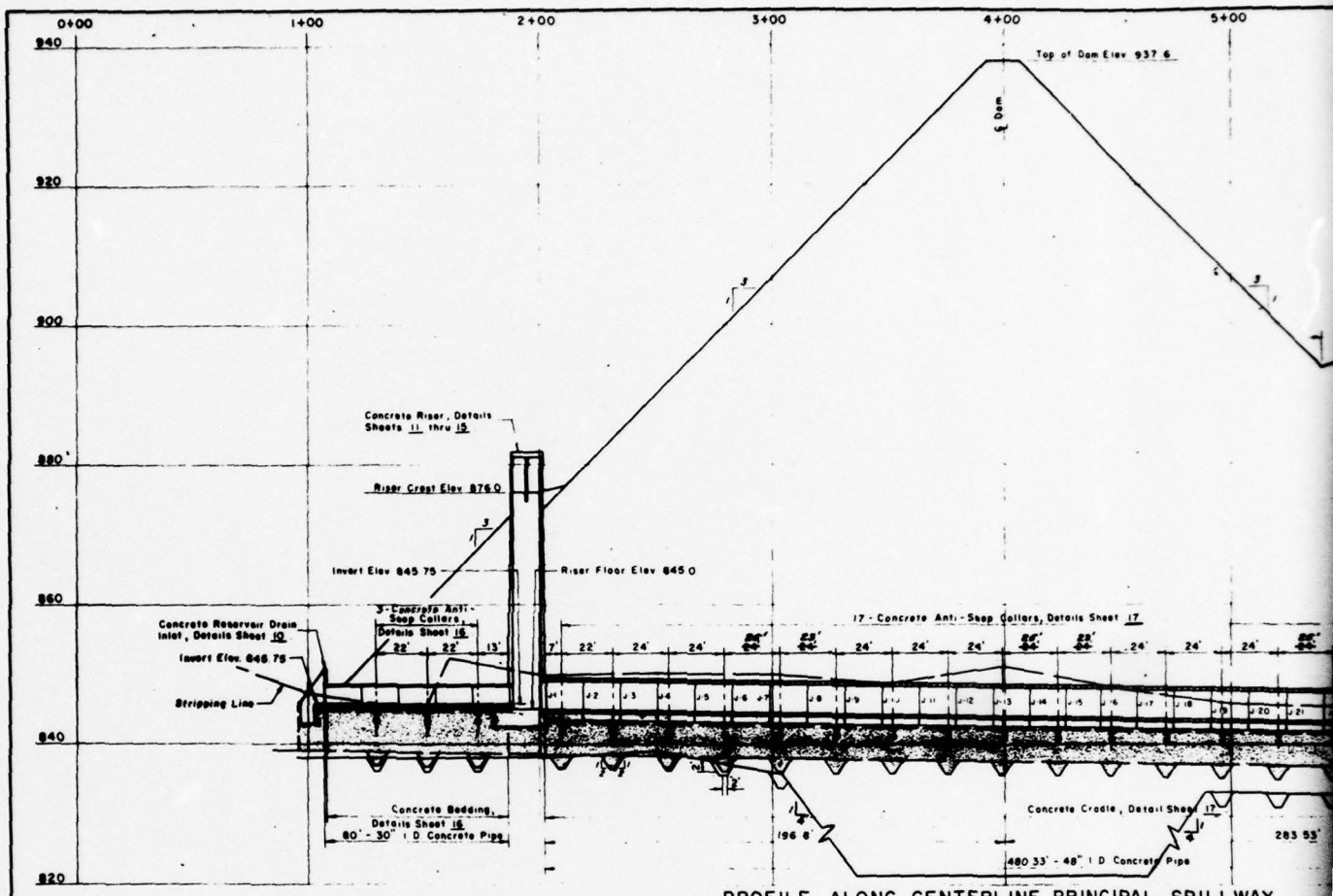
33
41

PA-647-P

PLATE 8

D'APPOLONIA

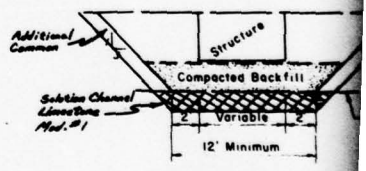
DRAWN BY	ACS	CHECKED BY	BE	3/1/79	DRAWING
	1-3-79	APPROVED BY	JHD	3.1.79	NUMBER 78-367-B45



PROFILE ALONG CENTERLINE PRINCIPAL SPILLWAY

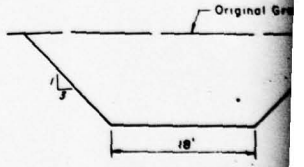
CONSTRUCTION NOTES

1. Riprap bedding shall meet fine drain fill gradation limits See sheet 7.
2. Inlet end of 30" pipe (bell end) and outlet end of 48" pipe (spigot end) to be finished so that no metal is exposed.
3. Pipe layout data will be furnished by the Engineer.
4. Layout shown is for 16' conduit sections. If 20' sections are used, some dimensions and quantities will change.
5. For cutoff trench excavation see sht. 6.



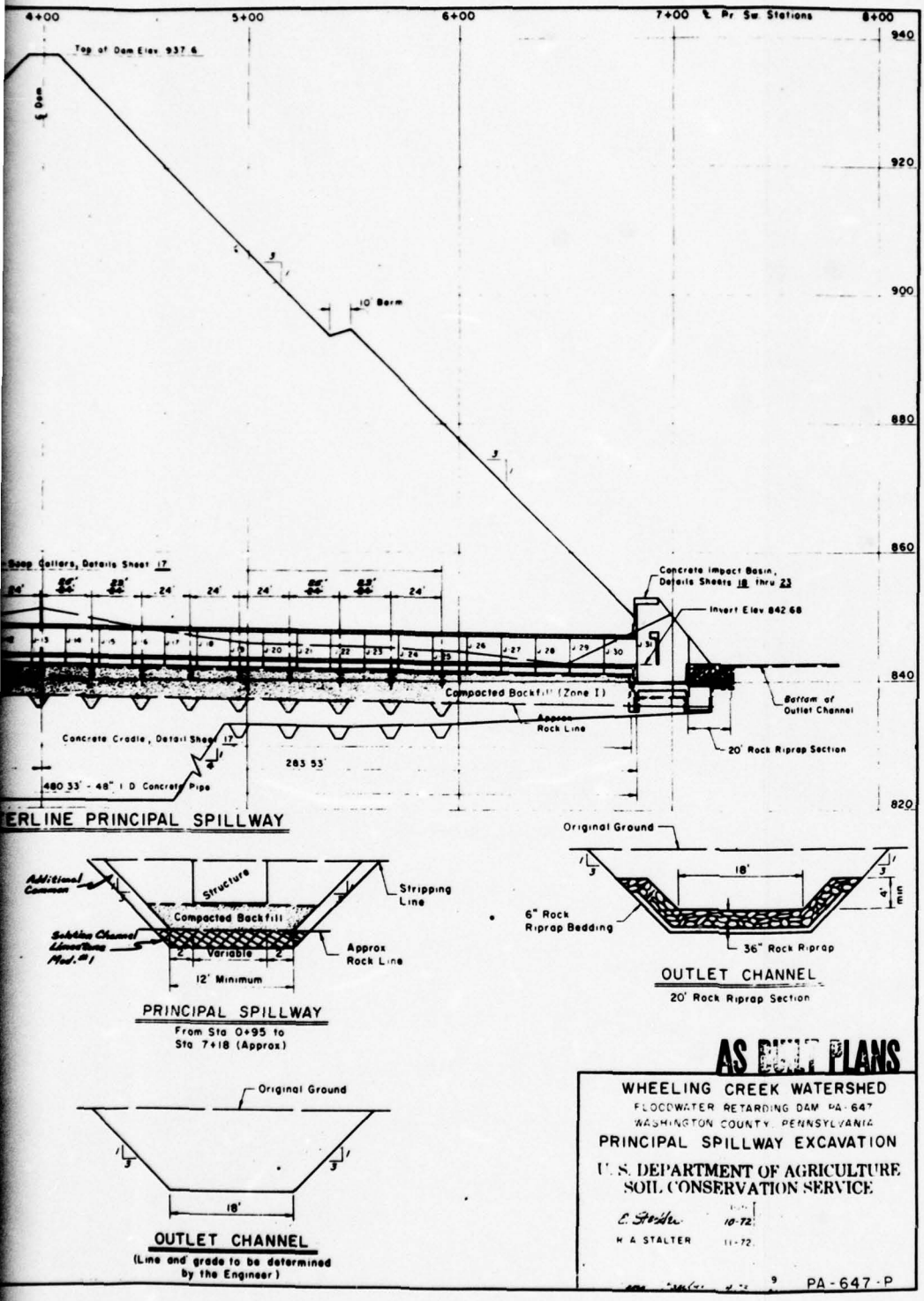
PRINCIPAL SPILLWAY

From Sta 0+95 to Sta 7+18 (Approx.)



OUTLET CHANNEL

(Line and grade to be determin by the Engineer)



AS BUILT PLANS

WHEELING CREEK WATERSHED
FLOODWATER RETARDING DAM PA-647
WASHINGTON COUNTY, PENNSYLVANIA
PRINCIPAL SPILLWAY EXCAVATION
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

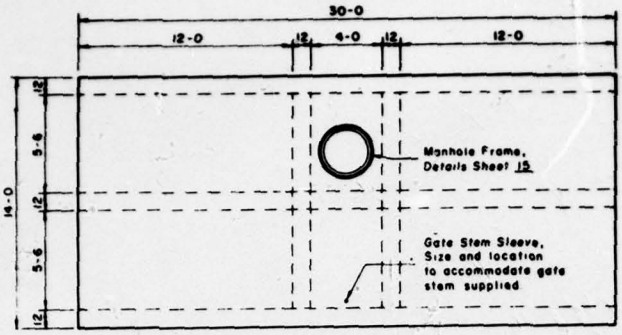
C. Stoltz 10-72
H A STALTER 11-72

9 PA-647-P

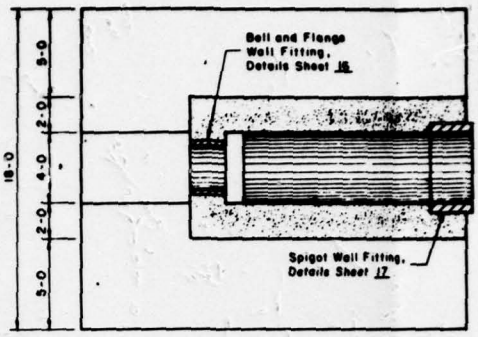
PLATE 9

D'APPOLONIA

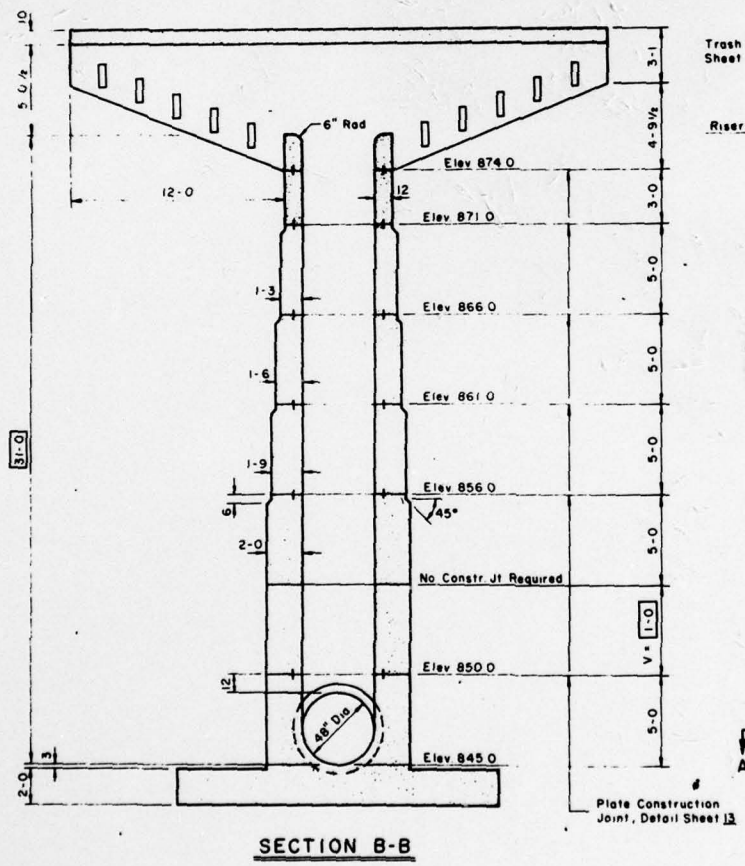
DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
ACS	RE	JHP	78-367-B46
1-3-79	3/1/79	3.1.79	



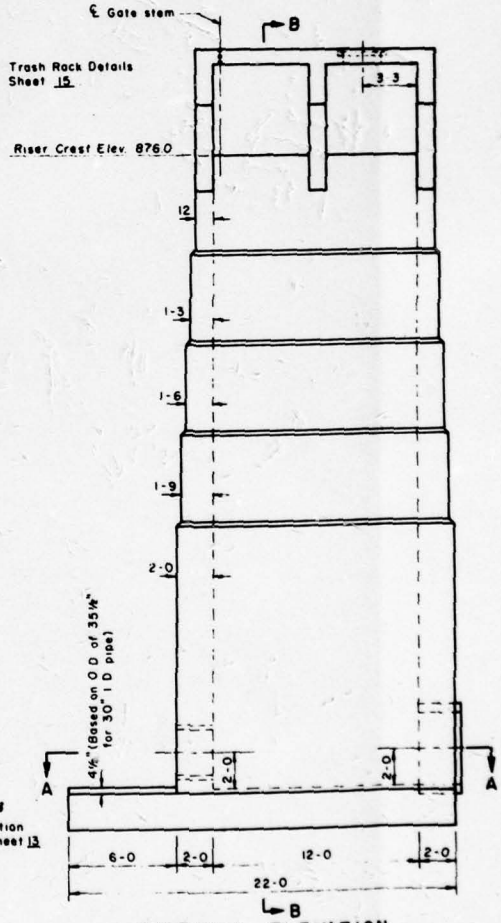
PLAN - TOP



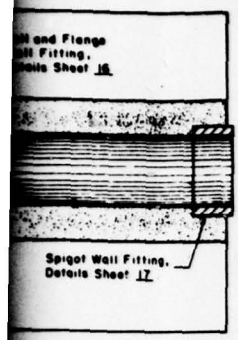
SECTION A-A



SECTION B-B



SIDEWALL ELEVATION



TION A-A

ELEVATION

RISER STEEL SCHEDULE

MARK	SIZE	QUANTITY	LENGTH	TYPE	B	C	TOTAL LENGTH
B1	6	6	17-6	STR			105-0
B2	7	25	17-6	STR			437-6
B3	6	18	13-9	STR			247-6
B4	8	36	10-6	STR			378-0
B5	7	94	13-8	21	4-11	8-9	1284-8
B6	6	18	21-6	STR			387-0
B7	6	13	17-6	STR			227-6
B8	8	3	17-6	STR			52-6
B9	8	12	17-6	STR			210-0
B10	6	8	9-8	21	1-0	8-8	77-4
B11	6	6	9-8	21	1-0	8-8	58-0
B12	6	24	9-8	21	1-0	8-8	232-0
B13	6	4	9-8	21	1-0	8-8	38-8
B14	7	14	13-0	STR			182-0
B15	6	6	5-0	STR			30-0
B16	7	24	14-0	21	5-0	9-0	336-0
B17	7	2	11-3	21	2-3	9-0	22-6
B18	7	4	10-11	21	1-11	9-0	43-8
B19	7	4	10-7	21	1-7	9-0	42-4
B20	7	4	10-4	21	1-4	9-0	41-4
B21	7	4	10-3	21	1-3	9-0	41-0
B22	7	2	11-6	21	2-6	9-0	23-0
B23	6	2	2-10	STR			5-8
B24	6	2	2-4	STR			4-8
B25	6	2	2-4	STR			4-8
B26	6	2	2-10	STR			5-8
B27	6	8	3-9	STR			30-0
R1	6	24	7-11	STR			190-0
R2	6	8	7-11	STR			63-4
R3	6	32	5-6	STR			176-0
R4	6	16	5-6	STR			88-0
R5	7	4	13-0	STR			52-0
R6	6	2	5-0	STR			10-0
R7	6	8	13-8	21	4-10	8-10	109-4
R8	5	20	13-0	STR			260-0
R9	6	10	5-0	STR			50-0
R10	6	36	13-8	21	4-10	8-10	492-0
R11	6	28	4-4	STR			121-4
R12	6	16	4-4	STR			69-4
R13	5	4	12-10	21	4-5	8-5	51-4
R14	6	24	6-11	STR			166-0
R15	6	8	6-11	STR			55-4
R16	6	30	4-6	STR			135-0
R17	6	14	4-6	STR			63-0
R18	5	20	13-0	STR			260-0
R19	6	10	5-0	STR			69-9
R20	5	36	12-10	21	4-5	8-5	462-0
R21	6	30	4-4	STR			130-0
R22	6	14	4-4	STR			60-8
R23	5	4	12-4	21	4-2	8-2	49-4
R24	6	24	6-11	STR			166-0
R25	6	8	6-11	STR			55-4
R26	6	30	4-6	STR			135-0
R27	6	14	4-6	STR			63-0
R28	5	20	13-0	STR			260-0
R29	6	10	5-0	STR			50-0
R30	5	36	12-4	21	4-2	8-2	444-0
R31	6	26	4-4	STR			112-8
R32	6	14	4-4	STR			60-8
R33	5	4	11-10	21	3-11	7-11	47-4
R34	6	24	6-7	STR			158-0
R35	6	8	6-7	STR			52-8
R36	6	28	4-6	STR			126-0
R37	6	12	4-6	STR			54-0
R38	5	32	13-0	STR			416-0
R39	6	16	5-0	STR			80-0
R40	5	36	11-10	21	3-11	7-11	426-0
R41	6	28	4-0	STR			112-0
R42	6	12	4-0	STR			48-0
R43	5	28	11-4	21	3-8	7-8	317-3
R44	6	36	4-0	STR			144-0
		12					
T1	5	12	13-6	STR			162-0
T2	6	12	12-9	STR			153-0
T3	5	6	7-0	STR			42-0
T4	5	12	9-0	STR			108-0
T5	5	6	13-0	STR			78-0
T6	5	6	17-0	STR			102-0
T7	5	6	21-3	STR			127-6
T8	5	6	25-6	STR			153-0
T9	5	24	29-6	STR			708-0
T10	5	4	13-6	STR			54-0
T11	5	4	13-0	STR			52-0
T12	5	4	14-0	STR			56-0
T13	6	8	4-5	21	1-9	2-8	35-4
T14	6	8	4-10	21	1-9	3-1	38-8
T15	6	8	5-3	21	1-9	3-6	42-0
T16	6	8	5-8	21	1-9	3-11	45-4
T17	6	8	6-1	21	1-9	4-4	48-8
T18	6	8	6-6	21	1-9	4-9	52-0
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T20	6	8	7-4	21	1-9	5-7	58-8
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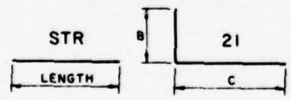
T23	6	8	8-7	21	1-9	6-10	68-8
T24	6	16	9-0	21	1-9	7-3	144-0
T25	6	12	9-4	21	1-9	7-7	112-0
T26	6	2	8-9	21	1-6	7-3	17-6
T27	6	2	8-6	21	1-3	7-3	17-0
T28	6	12	9-1	21	1-9	7-4	109-0
T29	6	4	8-8	21	1-9	6-11	34-8
T30	6	4	8-3	21	1-9	6-6	33-0
T31	6	4	7-10	21	1-9	6-1	31-4
T32	6	4	7-5	21	1-9	5-8	29-8
T55	6	4	7-0	21	1-9	5-3	28-0
T34	6	4	6-7	21	1-9	4-10	26-4
T35	6	4	6-2	21	1-9	4-5	24-8
T36	6	4	5-9	21	1-9	4-0	23-0
T37	6	4	5-4	21	1-9	3-7	21-4
T38	6	4	4-11	21	1-9	3-2	19-8
T39	6	4	4-6	21	1-9	2-9	18-0
T40	6	4	4-1	21	1-9	2-4	16-4
T41	6	60	1-4	STR			80-0
T42	5	44	13-6	STR			594-0
T43	5	4	8-3	STR			33-0
T44	5	2	7-9	STR			15-6
T45	5	4	2-9	STR			11-0
T46	5	2	2-3	STR			4-6

BAR TYPES



Note
For Construction Notes, see sheet 13

AS BUILT PLANS

0 1 2 3 4 6 8 FEET
SCALE

QUANTITIES (Riser Only)

STEEL

No 5 Bars	5293.8	Ft •	5805.5 Lbs
No. 6 Bars	6410.8	Ft •	9616.3 Lbs
No 7 Bars	2506.0	Ft •	5119.8 Lbs
No 8 Bars	640.5	Ft •	1710.1 Lbs
			~~21061.7~~ Lbs
			21,682 lbs.

CONCRETE

Mod. Proctor 216 lbs.

Class 4000 129 Cu Yds Reinforced

WHEELING CREEK WATERSHED
FLOODWATER RETARDING DAM PA-647
WASHINGTON COUNTY, PENNSYLVANIA
RISER
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

E Stalter 10-72
R A STALTER 11-72

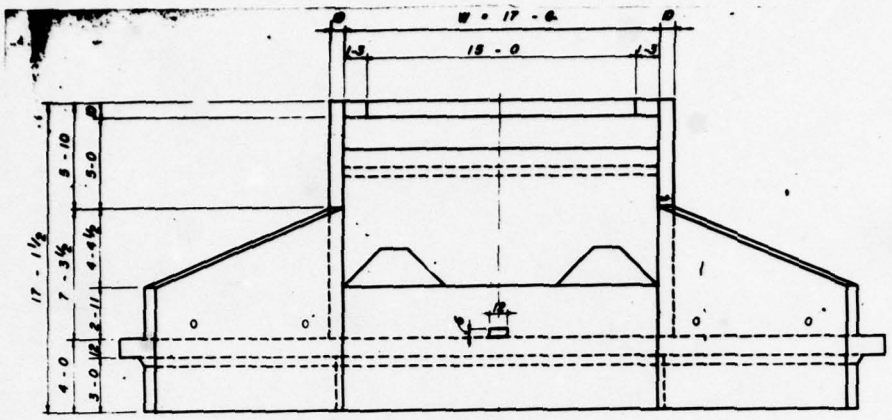
PA-647-P

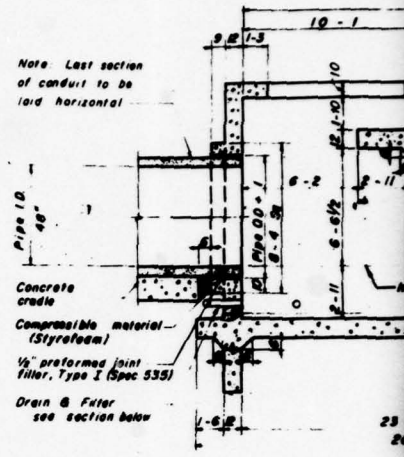
PLATE 10

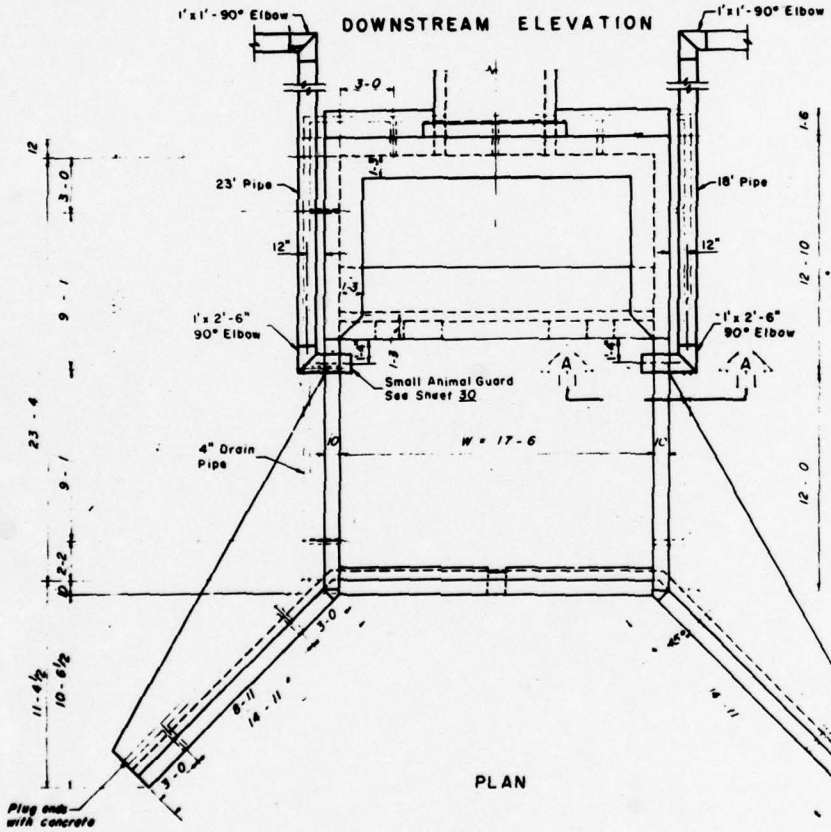
D'APPOLONIA

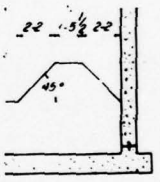
2

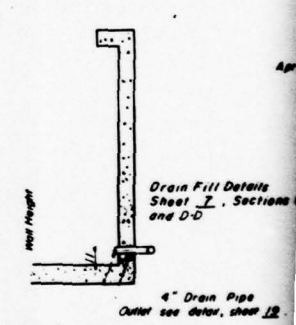
DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
ACS 1-3-79	BE 3/1/79	JMP 3.1.79	78-361-B47

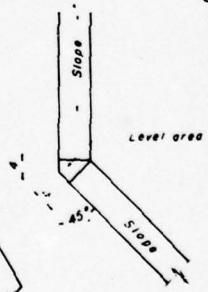


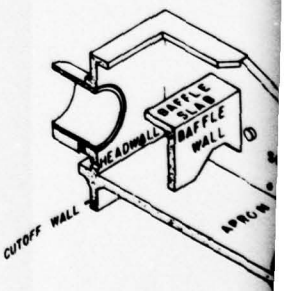








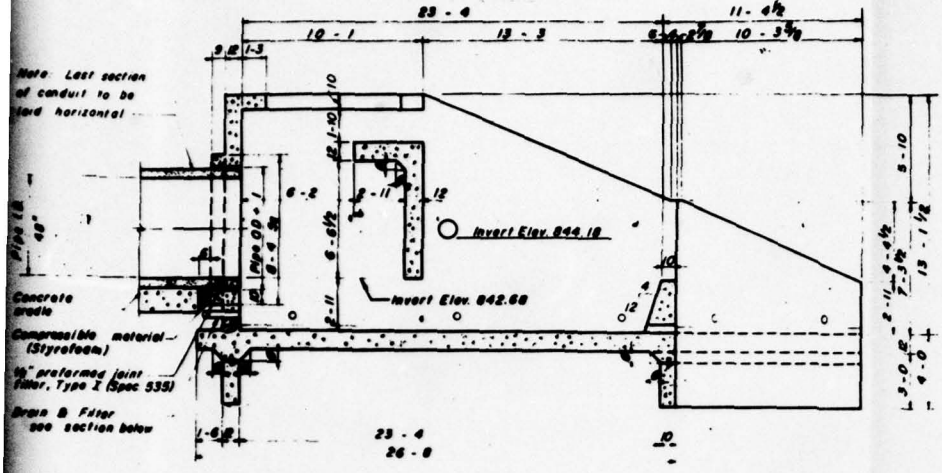




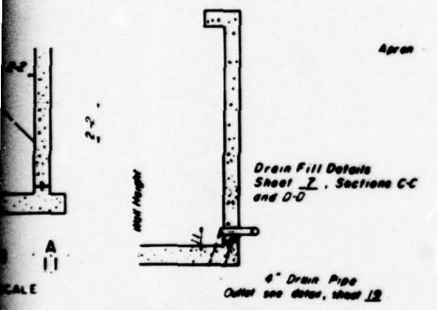
STANDARD IMPACT BASIN	
DESIGN CONSTANTS	f'_c = 4000psi f_c = 1600psi n = 8 f_s = 20,000psi
STANDARD DRAWING NO.	ES-4175
DATE 1-7[illegible]	SHEET 1 OF 5

CARL ROHDE
Consulting Engineer
654 Ridgeway Rd Lake Oswego Ore

SCALE IN FEET EXCEPT AS NOTED
0 5 10

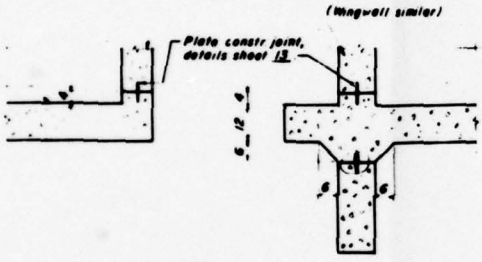


SECTION ON CENTERLINE



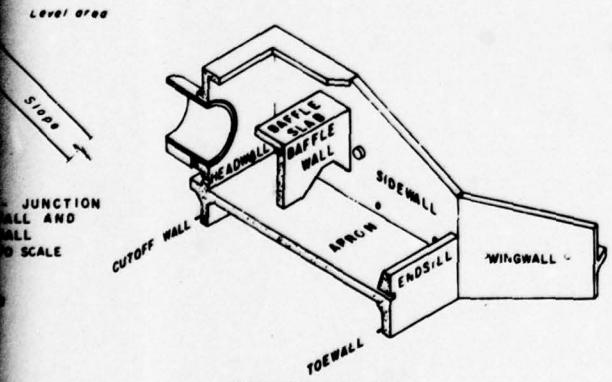
SECTION THROUGH DRAIN & FILTER

NOT TO SCALE



CONSTRUCTION JOINT DETAILS

NOT TO SCALE



ISOMETRIC VIEW

AS BUILT PLAN

QUANTITIES

Formwork (Contact area)	3080	Sq Ft
Reinforced Concrete	77	Cu Yds
Reinforcing Steel	14,100	lbs
Drainage		
4" Perforated drain pipe	126	Ln Ft
Animal screen detail, sheet 12	13	ea
Drain pipe tee (or std. dbl. tee branch)	13	ea
Drain pipe 90° ell	2	ea
Drain pipe 45° ell	2	ea

4" asbestos cement, perforated, underdrain pipe shall be used (Spec. 545, ASTM C-508)

Anchor
1/4" x 6" Carbon steel plate Structural grade 985 lbs

WHEELING CREEK WATERSHED
FLOODWATER RETARDING DAM PA-647
WASHINGTON COUNTY, PENNSYLVANIA
IMPACT BASIN

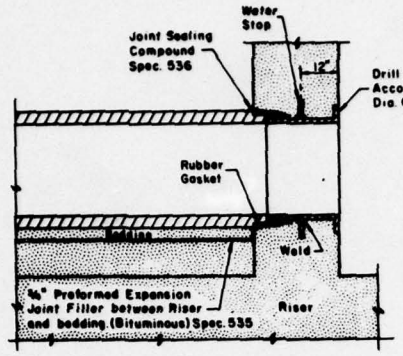
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed — Date
Drawn — Approved by
Traced — Title
Checked E. Stahler 11-72 — Sheet No. 10 of 61 — Drawing No. PA-647-P

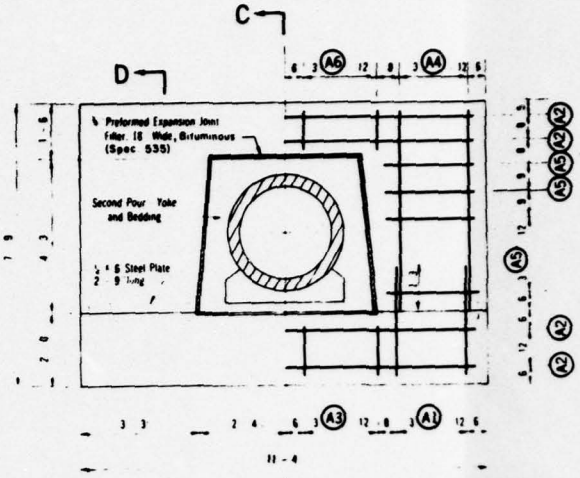
PLATE 11

D'APPOLONIA

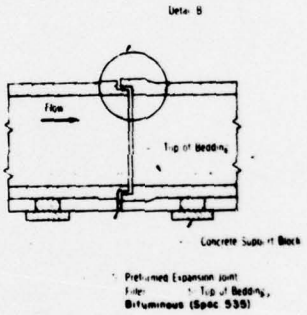
DRAWN BY	ACS	CHECKED BY	RJC	3/11/79	DRAWING NUMBER 78-367-B 48
	1-3-79	APPROVED BY	JMP	3.1.79	



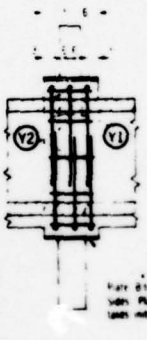
BELL & FLANGE WALL FITTING



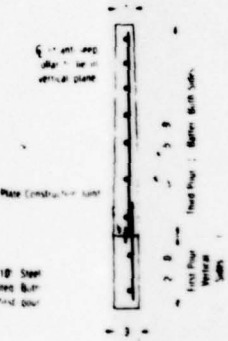
DETAIL OF ANTI-SEEP COLLAR



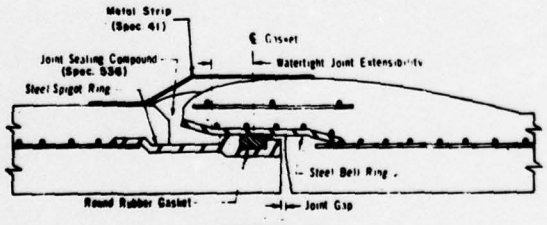
DETAIL OF PIPE JOINT



SECTION C-C



SECTION D-D



DETAIL B

STANDARD CONDUIT DETAILS
FOR
REINFORCED CONCRETE PRESSURE PIPE
PRINCIPAL SPILLWAY
STANDARD DWG. NO. ES-5080-BE
DATE 2-70 SHEET 1 OF 1

Joint length equals watertight joint extensibility plus joint gap.

The pipe shall be drawn together so that the maximum joint gap does not exceed ⅝ inch for pipe laid on a straight line. For cambered pipe or pipe laid on a curved line, the joint gap at the closest point shall not exceed ¾ inch.

JOINT REQUIREMENTS

Length of Pipe Section	Minimum Joint Length	Minimum Joint Deflecting Angle	
feet	inches	radians	degrees
≤ 20	1-1/8	0.0229	1°-18'

For pipe length other than shown, joint requirements will be determined by the Engineer.

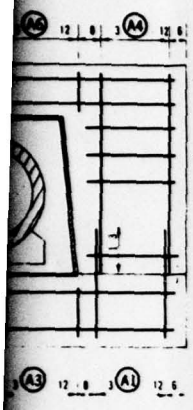
Where pipes of different length are connected, adjoining pipes shall meet the requirements of the longer pipe.

Prior to delivery of pipe, the pipe joint detail proposed for use shall be submitted to the Engineer for approval.

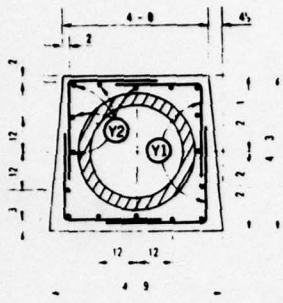
STRENGTH REQUI

Inside Diameter of Pipe	Internal Load	
	Hydrostatic Pressure	Minimum ... Pounds ... Applicable ... Load C...
	Head of Water	Load to produce ... one foot ...
inches	feet	
30	92.6	6,240

The outside diameter of pipe assumed ... Where the pipe furnished has an outside ... assumed in design, the three-edge bear... furnished must not be less than the ... ing strength multiplied by the ratio of ... the pipe furnished to the outside diam...



SEEP COLLAR



DETAIL OF ANTI-SEEP COLLAR YOKE

STEEL SCHEDULE

Anti-seep Collar and Yoke. 3 Required.

Mark	Size	Quantity per Collar	Length	Type	Total Quantity	Total Length
A1	4	6	3 - 0	1	18	54 - 0
A2	4	4	10 - 10	1	12	130 - 0
A3	4	6	1 - 6	1	18	27 - 0
A4	4	6	5 - 6	1	18	99 - 0
A5	4	10	2 - 9	1	30	82 - 6
A6	4	6	1 - 8	1	18	18 - 0
Y1	4	12	9 - 2	21	36	198 - 0
Y2	4	16	1 - 2	1	48	66 - 0

QUANTITIES

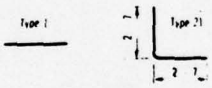
Concrete	Cu. Yds.
Anti-seep Collar including Yoke	
* Each	2.399
Total	7.198
Bedding	
** Per Lineal Foot of Bedding	0.0747
Total	8.88
Steel	Pounds
Anti-seep Collar including Yoke	439.67

Concrete quantities are based on the outside diameter of pipe of 30 inches. Steel quantities do not change with outside diameter of pipe.

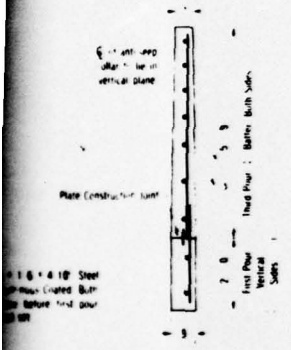
* This quantity is given by
2.339 - 0.0003030 $(D_f)^2$ + 30 - D_f 30, cu. yds

** This quantity is given by
0.0734 - 0.0005 $(D_f)^2$ 30, cu. yds

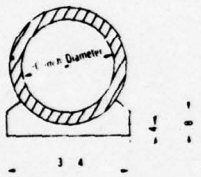
D_f outside diameter of pipe furnished, inches



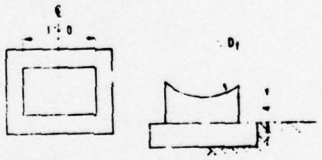
BAR TYPES



SECTION D-D



DETAIL OF BEDDING



SUGGESTED SUPPORT BLOCKS

Sufficient blocks shall be provided to support the pipe to the required line and grade. The Contractor shall determine the number and size of blocks required [illegible] alternate

AS BUILT PLANS

STRENGTH REQUIREMENTS

Inside Diameter of Pipe	Internal Load: Hydrostatic Pressure	External Load: Minimum 3 Edge Bearing Strength in Pounds per Linear Foot of Pipe	
		Applicable Standard Specification	
		AASHTO M-170	AASHTO M-170
	Head of Water	Load to produce .01 inch crack one foot long	Load to produce .01 inch crack one foot long
inches	feet		
30	92.6	6,348	8,442

The outside diameter of pipe assumed in design is 38.0 inches. Where the pipe furnished has an outside diameter greater than assumed in design, the three-edge bearing strength of the pipe furnished must not be less than the specified three-edge bearing strength multiplied by the ratio of the outside diameter of the pipe furnished to the outside diameter assumed in design

WHEELING CREEK WATERSHED
FLOODWATER RETARDING DAM PA-647
WASHINGTON COUNTY, PENNSYLVANIA
CONDUIT

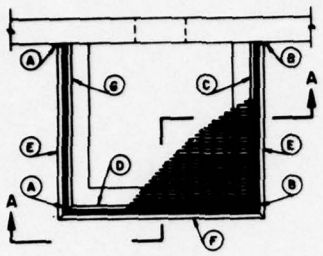
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	Date	Approved by
Drawn		Title
Traced		Title
Checked C. Stokes	11-72	Sheet No. 16 of 41 — Drawing No. PA-647-P

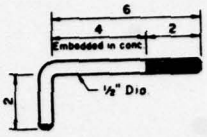
PLATE 12

D'APPOLONIA

DRAWN BY	ACS	CHECKED BY	BE	3/1/77	DRAWING NUMBER 78-307-B 49
	1-3-79	APPROVED BY	JHP	3.1.77	

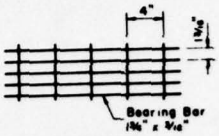


PLAN

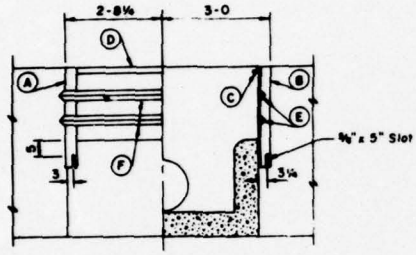


ANCHOR BOLT

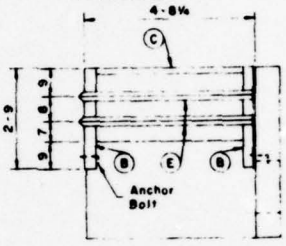
SUPPLY WITH HEX NUTS AND LOCK WASHERS ASTM A-276



GRATING



SECTION A-A



SIDE

0 1 2 3 4 FEET
SCALE

BILL OF MATERIALS

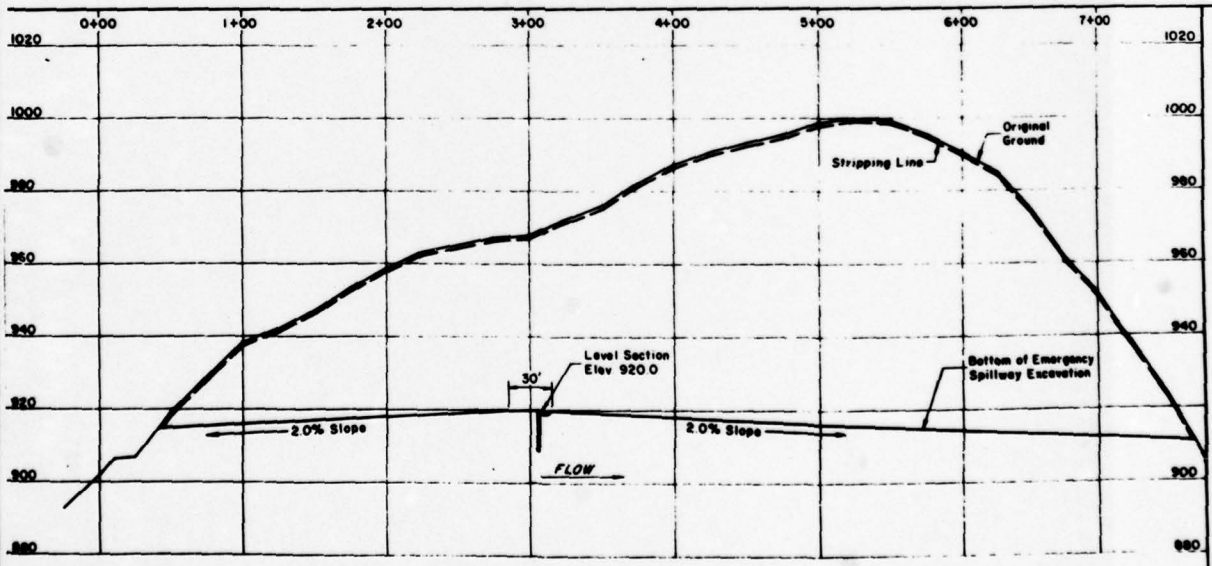
ITEM	SIZE	LENGTH	QUANTITY
Angle (A)	4 x 4 x ¼	2-9	2
" (B)	"	2-9	2
" (C)	2 x 2 x ¼	4-8	1
" (D)	"	5-4	1
" (E)	"	4-9½	4
" (F)	"	5-7½	2
" (G)	"	4-8	1
Grating	5-3½ x 4-7½	—	1
Anchor Bolt	½ Dia	2 x 6	4

CONSTRUCTION DETAILS

1. Angles and grating in trash rack shall conform to Spec 581 for aluminum alloy
2. Anchor bolts, nuts and washers shall be stainless steel and conform to ASTM A-276
3. Grating fasteners to be sized and spaced according to manufacturers recommendations Grating to be removable
4. Aluminum surfaces placed in contact with concrete, shall be given a heavy coat of an alkali-resistant, bituminous paint before installation (Military Spec MIL-P-6883A)
5. All points of contact between angles to be welded

EMERGENCY SPILLWAY DROP INLET TRASH RACK

(2 REQUIRED)



PROFILE ALONG CENTERLINE EMERGENCY SPILLWAY

OF MATERIALS

SIZE	LENGTH	QUANTITY
″ x ¼	2-9	2
″	2-9	2
″ x ¼	4-8	1
″	5-4	1
″	4-9½	4
″	5-7½	2
″	4-8	1
″ x 4-7½	—	1
″ Dia	2 x 6	4

CTION DETAILS

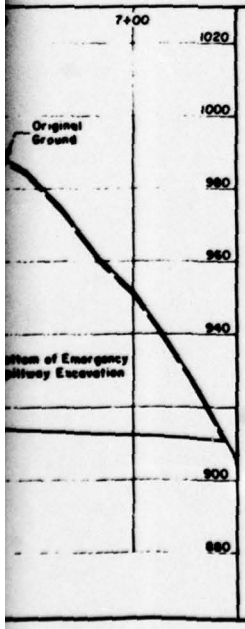
… grating in trash rack shall … Spec. 501 for aluminum alloy

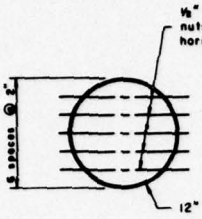
…ts, nuts and washers shall be …ntact and conform to ASTM A-276

…eners to be sized and spaced … manufacturers recommendations … be removable

…surfaces placed in contact with …shall be given a heavy coat of an …ntant, bituminous paint before … (Military Spec. MIL-P-6883A)

… of contact between angles …ded





SMALL ANIMAL GUARD
(2 REQUIRED)

AS BUILT PLANS

WHEELING CREEK WATERSHED
FLOODWATER RETARDING DAM PA-647
WASHINGTON COUNTY, PENNSYLVANIA
MISCELLANEOUS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date	Approved by
E. Stechler	11-72	
R A STALTER	12-72	

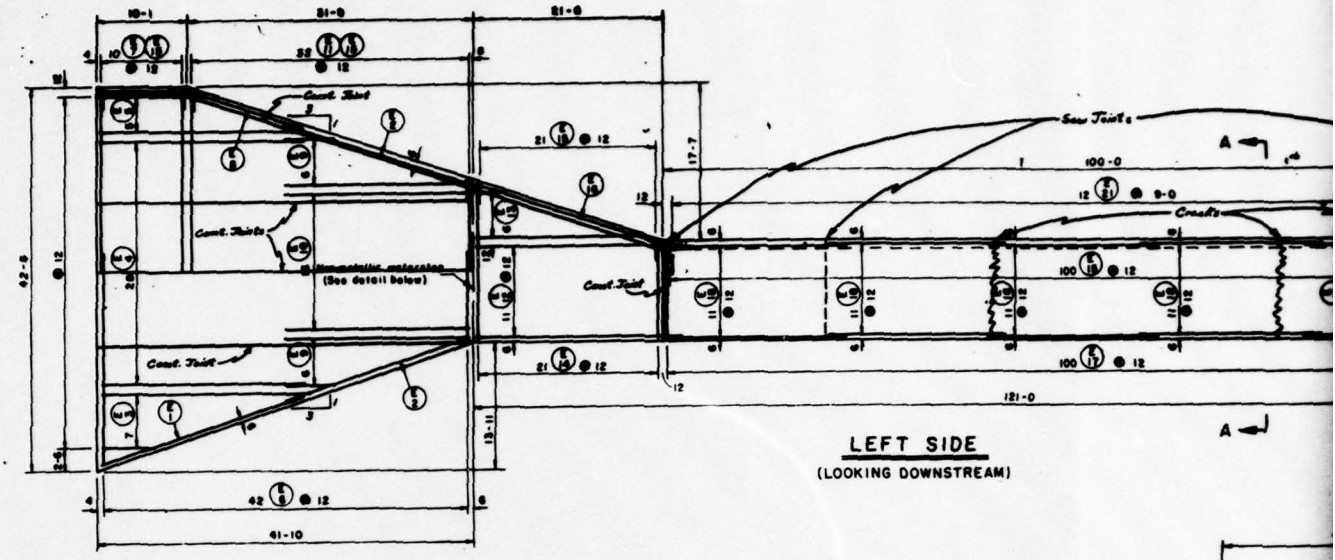
PA-647-P

PLATE 13

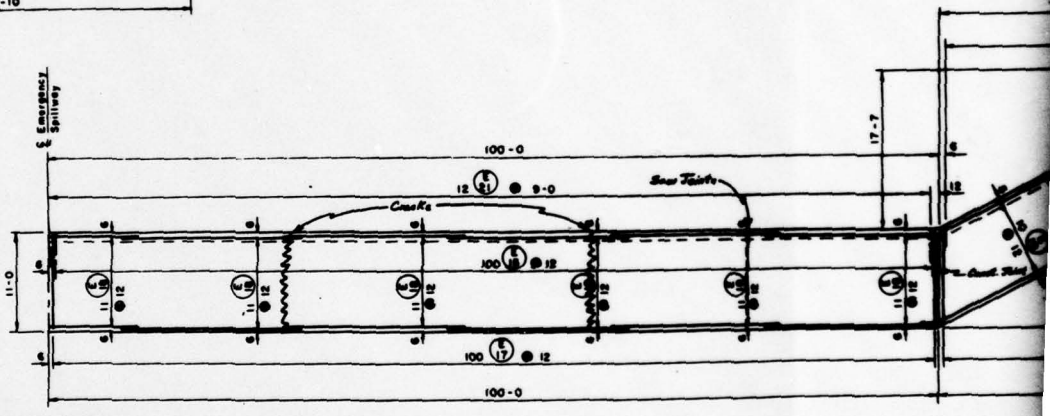
D'APPOLONIA

2

DRAWN BY	ACS	CHECKED BY	RE	3/1/79	DRAWING NUMBER 78-3[illegible]-B50
	1-3-79	APPROVED BY	JHP	3.1.79	



LEFT SIDE
(LOOKING DOWNSTREAM)



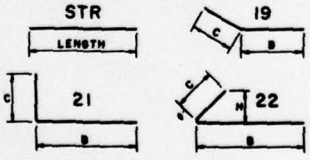
RIGHT SIDE
(LOOKING DOWNSTREAM)

STEEL SCHEDULE

MARK	SIZE	QUANTITY	LENGTH	TYPE	B	C	H	*ΔL	TOTAL LENGTH
1	6	1	23-9	STR					23-9
2	6	6	21-6	STR					129-0
3	6	7	6-0 to 24-0	STR				3-0	105-0
4	6	28	22-6	STR					630-0
5	6	5	12-0 to 24-0	STR				3-0	90-0
6	6	42	23-6 to 9-10	STR				0-4	700-0
7	6	10	20-0	STR					200-0
8	6	5	23-3	19	9-6	13-9	0-8		116-3
9	6	12	5-6 to 20-6	STR	(2 sets of 6)			3-0	156-0
10	6	16	20-6	STR					328-0
11	6	36	9-6 to 20-0	STR				0-4	474-8
12	6	11	22-6	STR					250-3
13	6	6	3-3 to 18-3	STR				3-0	64-6
14	6	21	10-4 to 17-0	STR				0-4	287-0
15	6	1200	5-6	21	3-9	1-9			1650-0
16	6	5	24-0	19	22-0	2-0	0-8		120-0
17	6	187	10-6	STR					2488-6
18	6	188	20-0	STR					3900-0
19	6	14	24-6	19	22-6	2-0	0-10		343-0
20	6	14	21-0	STR					294-0
21	11	28	14-9	22	12-3	2-0	1-5		335-0

*ΔL Denotes the change in length between adjacent bars in a set

BAR TYPES



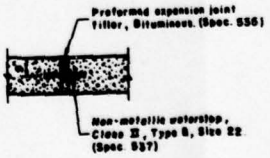
QUANTITIES (This Sheet Only)

STEEL

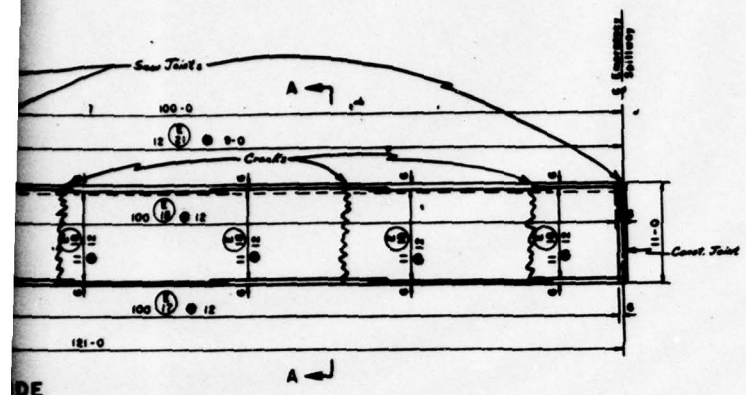
No. 6 Bars 11,780 Ft. = 17,649 Lbs.
No. 11 Bars 339 Ft. = 1,801 Lbs.
19,480 Lbs.

CONCRETE

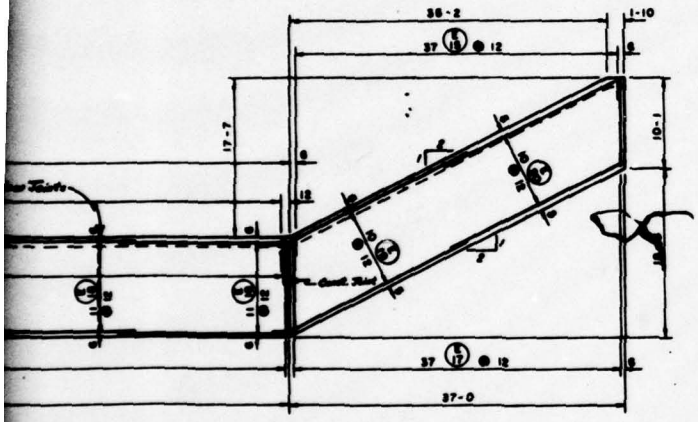
Class 4000 272.2 Cu Yds. Reinforced



NON-METALLIC WATERSTOP



DE
TREAM)

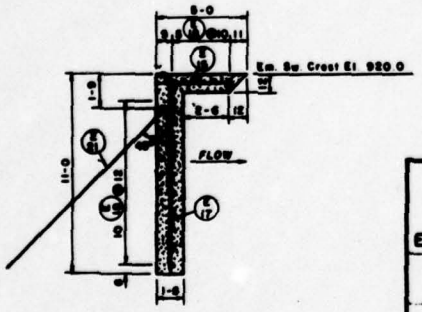


IDE
TREAM)

Preformed expansion joint filler, Bituminous. (Spec. 536)

Non-metallic waterstop, Class II, Type B, Size 22. (Spec. 537)

ALLIC WATERSTOP



SECTION A-A

0 1 2 3 4 5 6 7 8 FEET
SCALE

For Construction Notes, see sheet 11

0 1 4 8 16 FEET
SCALE

AS BUILT PLANS

WHEELING CREEK WATERSHED
FLOODWATER RETARDING DAM PA-647
WASHINGTON COUNTY, PENNSYLVANIA
EMERGENCY SPILLWAY CUTOFF WALL

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

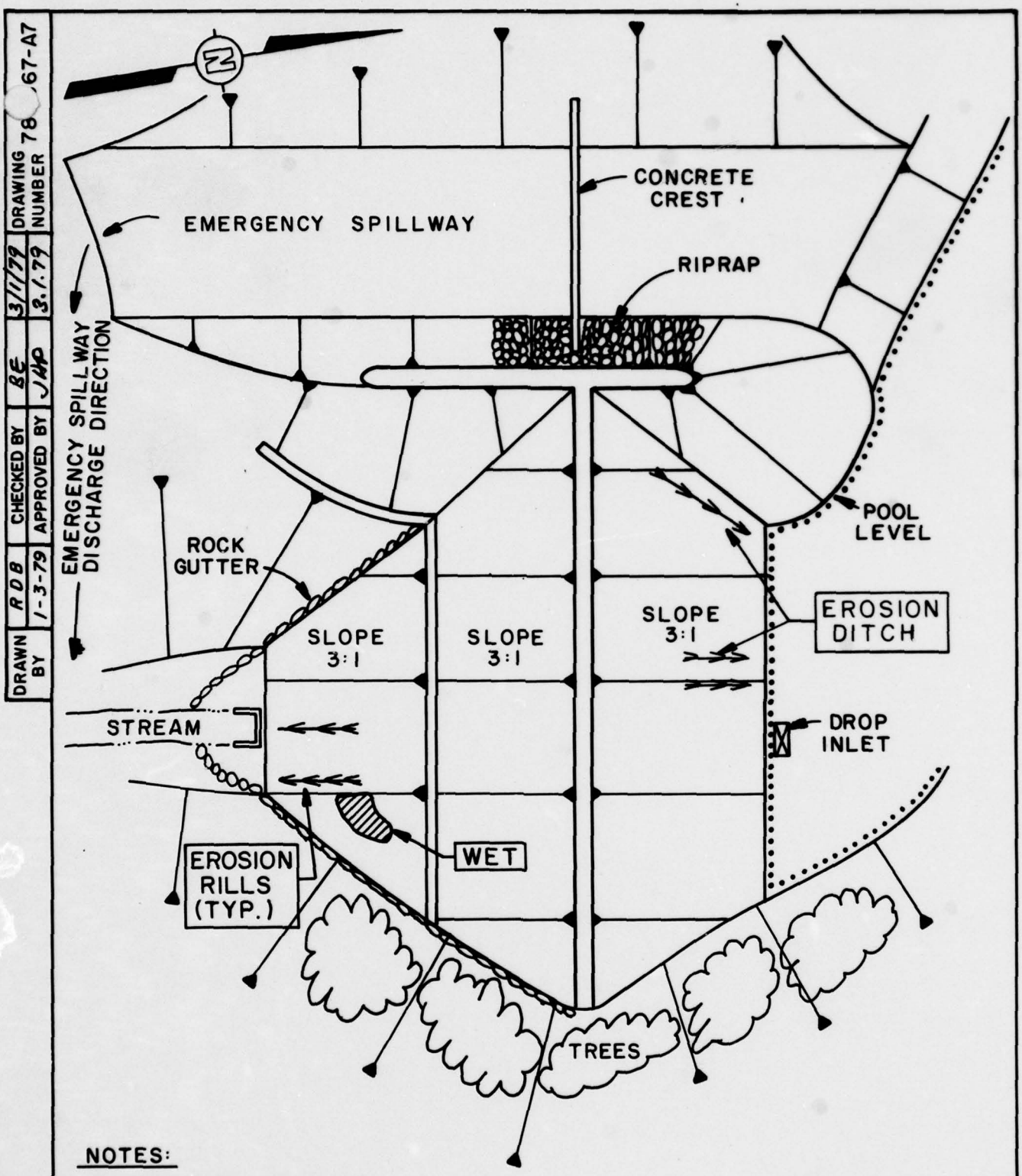
Designed R. Stalter	Date 9-73	Approved by	
Drawn R. A. STALTER	9-73	Title	
Traced		Title	
Checked David P. Kessler	9-30	Sheet No. 20 of 61	Drawing No. PA-647-P

43

PLATE 14

D'APPOLONIA

2



NOTES:

1. EMERGENCY SPILLWAY FREEBOARD: 17.6 FEET
2. POOL LEVEL DATE OF INSPECTION: 43.5 FEET BELOW EMERGENCY SPILLWAY CREST.

NOT TO SCALE

PLATE 15

PA. 647 DAM
GENERAL PLAN
FIELD INSPECTION NOTES
FIELD INSPECTION DATE: DEC. 8, 1978

D'APPOLONIA

APPENDIX A

CHECKLIST
VISUAL INSPECTION
PHASE I

APPENDIX A

CHECKLIST
VISUAL INSPECTION
PHASE I

NAME OF DAM PA-647 COUNTY Washington STATE Pennsylvania ID# NDI I.D. NO. PA-821
DER I.D. NO. 63-76

TYPE OF DAM Earth HAZARD CATEGORY High

DATE(S) INSPECTION December 8, 1978 WEATHER Rainy TEMPERATURE 50s

POOL ELEVATION AT TIME OF INSPECTION 876.8 M.S.L. TAILWATER AT TIME OF INSPECTION 844.9 M.S.L.

INSPECTION PERSONNEL:	REVIEW INSPECTION PERSONNEL: (December 21, 1978)
Bilgin Erel	L. D. Andersen
Wah-Tak Chan	J. H. Poellot
	Bilgin Erel

Bilgin Erel RECORDER

VISUAL INSPECTION
PHASE I
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Several erosion gullies on the upstream face near the right abutment 6 to 8 inches deep. Smaller erosion gullies on the downstream face below berm level.	The erosion gullies should be filled and vegetated.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Crest elevation is within two-tenths of a foot of the design elevation relative to the emergency spillway crest level.	
RIPRAP FAILURES	No riprap on the dam. Riprap on the embankment side of the emergency spillway channel; satisfactory.	

VISUAL INSPECTION
PHASE I
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No signs of distress.	
ANY NOTICEABLE SEEPAGE	One wet area on the downstream slope below berm level near the left abutment.	The wet area should be closely observed to document if a seepage condition is developing.
STAFF GAGE AND RECORDER	None.	
DRAINS	Drainage blanket pipes drain into the side of the outlet structure. There is no flow in the drainpipes.	

VISUAL INSPECTION
PHASE I
OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	The visible portions of the outlet works are in good condition.	
INTAKE STRUCTURE	In good condition.	
OUTLET STRUCTURE	In good condition.	
OUTLET CHANNEL	No significant obstructions.	
EMERGENCY GATE	Reservoir drainpipe gate hoist is located in the drop inlet structure. Not accessible for inspection.	The operational condition of the reservoir drainpipe gate should be periodically evaluated.

VISUAL INSPECTION
PHASE I
UNGATED SPILLWAY (EMERGENCY SPILLWAY)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Concrete cutoff wall across the spillway channel. In good condition.	
APPROACH CHANNEL	Trapezoidal earth channel. In good condition.	
DISCHARGE CHANNEL	Trapezoidal earth channel. In good condition.	
BRIDGE AND PIERS	None.	

VISUAL INSPECTION
PHASE I
GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

VISUAL INSPECTION
PHASE I
INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None found.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	Toe drainpipes discharging into the outlet structure. No flow in the drainpipes.	

VISUAL INSPECTION
PHASE I
RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Steep to moderate.	
SEDIMENTATION	Unknown.	
UPSTREAM RESERVOIRS	No major impoundments.	

VISUAL INSPECTION
PHASE I
DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	No apparent obstructions immediately downstream from the dam.	
SLOPES	No apparent instability (immediately downstream from the dam).	
APPROXIMATE NUMBER OF HOMES AND POPULATION	Community of Alley Grove is located approximately one mile downstream from the dam. There are approximately 20 homes in Alley Grove and one major natural gas pump station near Alley Grove. Population: approximately 100.	

APPENDIX B

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
AND HYDROLOGIC AND HYDRAULIC
PHASE I

APPENDIX B

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM PA-647
ID# NDI I.D. NO. PA-821
DER I.D. NO. 63-76

ITEM	REMARKS
AS-BUILT DRAWINGS	The drawings are available in state and Soil Conservation Service files.
REGIONAL VICINITY MAP	See Plate 1.
CONSTRUCTION HISTORY	The dam was designed by the U.S. Department of Agriculture, Soil Conservation Service. It was constructed by Monroeville Construction Company of Monroeville, Pennsylvania, with completion in July 1977.
TYPICAL SECTIONS OF DAM	See Plate 3.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	See Plates 9, 10, 11 and 12.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	Not available.
DESIGN REPORTS	*Soil Conservation Service internal memo dated August 3, 1971.*
GEOLOGY REPORTS	Detailed Geologic Investigation of Dam Sites, SCS Form 376, dated September 1970.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Hydrology, hydraulics, geotechnical and structural calculations are available in SCS files.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Included in design and geology reports (see Plate 4 for typical subsurface profile). See Plates 7 and 8 for selected boring logs.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
POST CONSTRUCTION SURVEYS OF DAM	None reported.
BORROW SOURCES	Described in engineer's report.
MONITORING SYSTEMS	None.
MODIFICATIONS	None reported.
HIGH POOL RECORDS	Not recorded.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None reported.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None reported.
MAINTENANCE OPERATION RECORDS	Not available.
SPILLWAY PLAN SECTIONS DETAILS	Primary spillway: See Plates 9, 10, 11 and 12. Emergency spillway: See Plates 13 and 14.
OPERATING EQUIPMENT PLANS AND DETAILS	Available in SCS files.

CHECKLIST
ENGINEERING DATA
HYDROLOGIC AND HYDRAULIC

DRAINAGE AREA CHARACTERISTICS: 22.4 square miles (wooded)

ELEVATION; TOP NORMAL POOL AND STORAGE CAPACITY: 876 (279 acre-feet)

ELEVATION; TOP FLOOD CONTROL POOL AND STORAGE CAPACITY: 920 (3713 acre-feet)

ELEVATION; MAXIMUM DESIGN POOL: 937.6 (high point); 937.5 (low point)

ELEVATION; TOP DAM: 939.6

SPILLWAY: (Emergency Spillway)

a. Elevation 920

b. Type Trapezoidal open channel (critical depth overflow section)

c. Width 200 feet (base width perpendicular to flow direction)

d. Length 400± feet (from crest to end of trapezoidal section)

e. Location Spillover Adjacent to emergency spillway

f. Number and Type of Gates None

OUTLET WORKS:

a. Type 30- and 48-inch reinforced concrete conduit

b. Location Near left abutment

c. Entrance Inverts El. 845.75

d. Exit Inverts El. 842.68

e. Emergency Draindown Facilities 30-inch pipe

HYDROMETEOROLOGICAL GAGES:

a. Type None

b. Location None

c. Records None

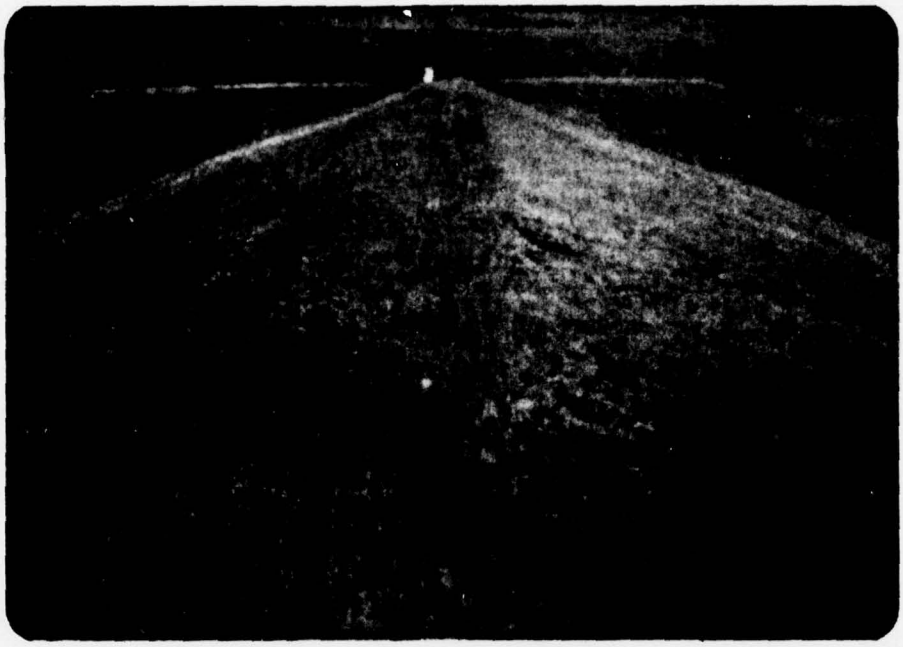
MAXIMUM NONDAMAGING DISCHARGE: Emergency spillway discharge capacity (50,000+ cfs)

APPENDIX C

PHOTOGRAPHS

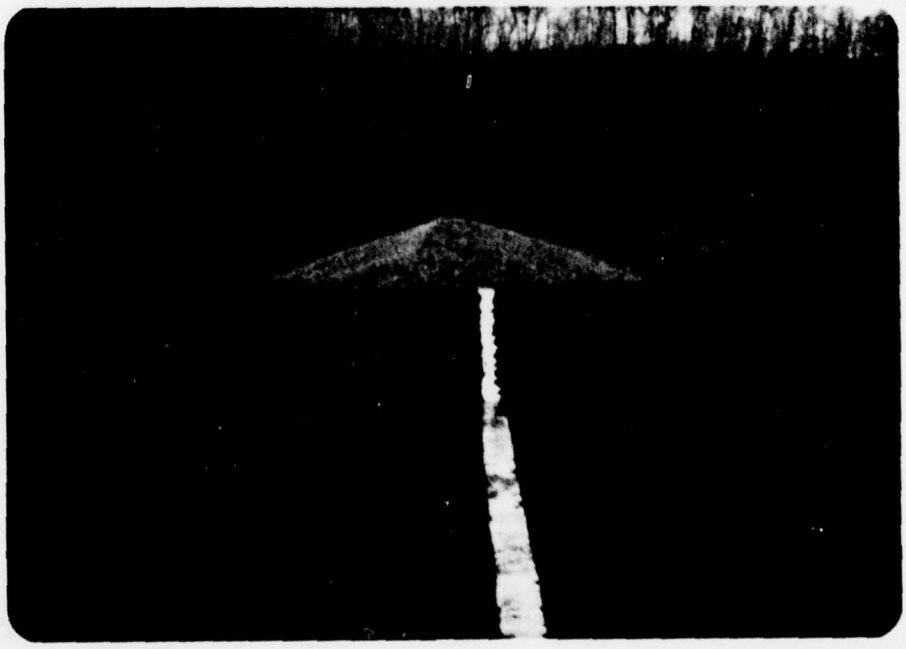
LIST OF PHOTOGRAPHS
PA-647 DAM
NDI I.D. NO. PA-821
DECEMBER 8, 1978

PHOTOGRAPH NO.	DESCRIPTION
1	Crest (looking west).
2	Crest (looking east). Spillway crest in foreground.
3	Primary spillway, drop inlet structure.
4	Impact basin.
5	Gas pump station (one mile downstream).
6	Community of Alley Grove (two miles downstream).



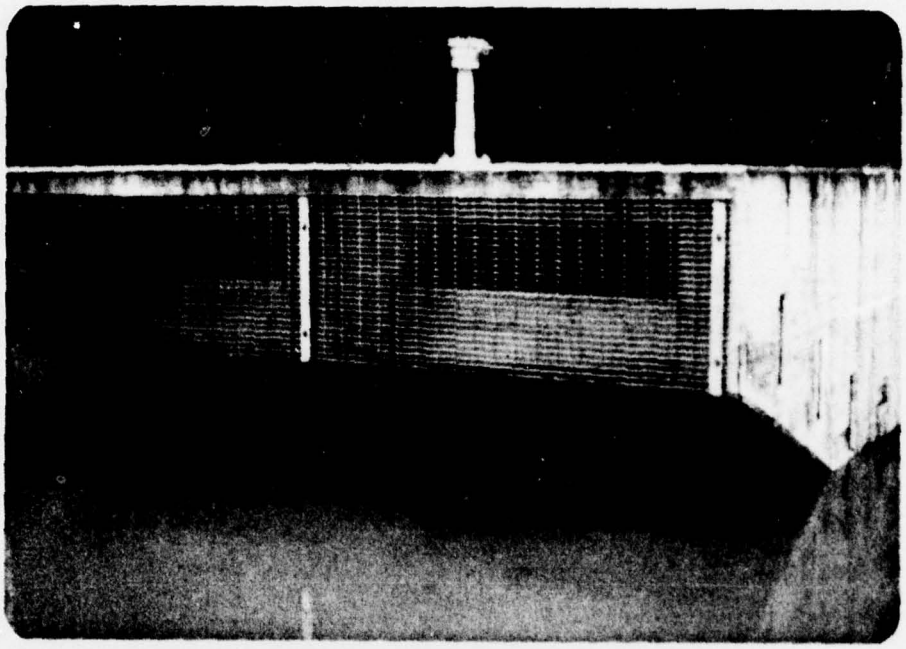
Photograph No. 1

Crest (looking west).



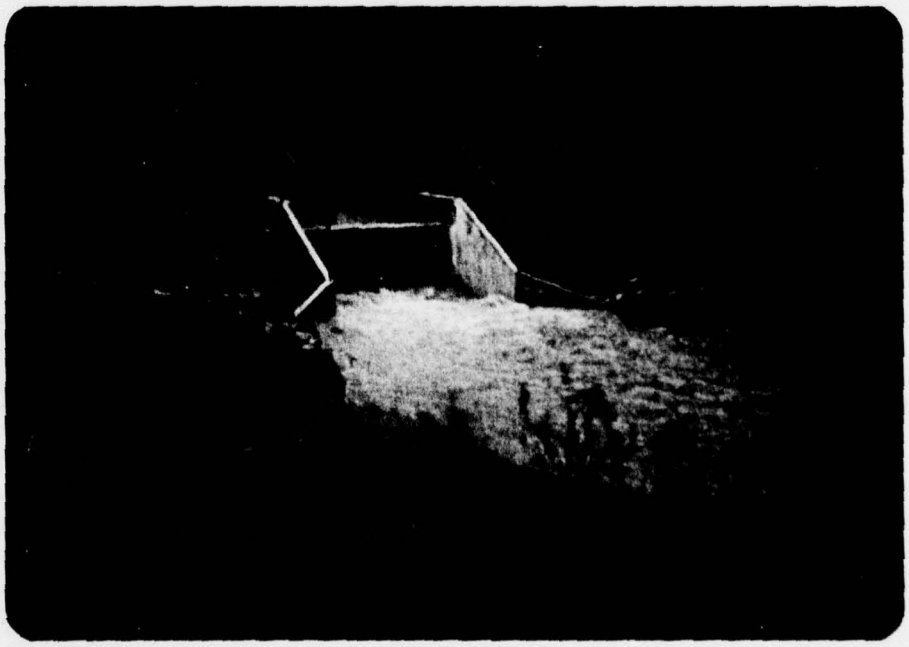
Photograph No. 2

Crest (looking east). Spillway crest in foreground.



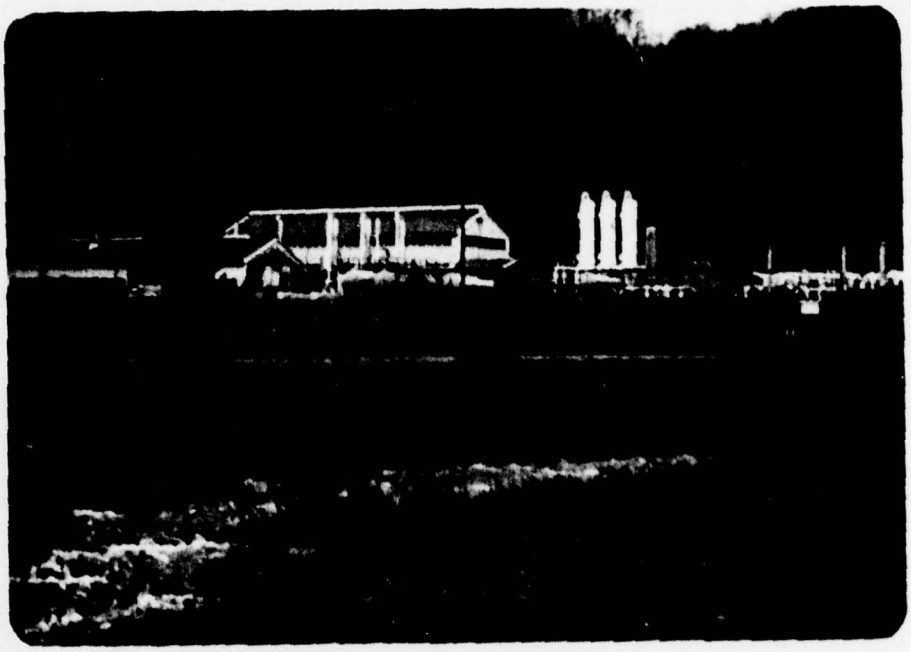
Photograph No. 3

Primary spillway, drop inlet structure.



Photograph No. 4

Impact basin.



Photograph No. 5

Gas pump station (one mile downstream).

Photograph No. 6

Community of Alley Grove (two miles downstream).

APPENDIX D

CALCULATIONS

HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: PA-647 (NDI I.D. PA-821)

PROBABLE MAXIMUM PRECIPITATION (PMP) = 24.3 INCHES/24 HOURS[1]

STATION	1	2	3	4	5
Station Description	Reservoir	Dam			
Drainage Area (square miles)	22.4	0			
Cumulative Drainage Area (square miles)	22.4	22.4			
Adjustment of PMF for Drainage Area (%)[2]					
6 Hours	95	-			
12 Hours	114	-			
24 Hours	124	-			
48 Hours	134	-			
72 Hours	-	-			
Snyder Hydrograph Parameters					
Zone[3]	28B	-			
C_p/C_t[4]	0.57/1.7	-			
L (miles)[5]	12.1	-			
L_{ca} (miles)[5]	6.4	-			
$t_p = C_t(L \cdot L_{ca})0.3$ (hours)	6.3	-			
Spillway Data					
Crest Length (ft)	-	200			
Freeboard (ft)	-	17.6			
Discharge Coefficient	-	3.1			
Exponent	-	1.5			

(1) Hydrometeorological Report 33 (Figure 1), U.S. Army, Corps of Engineers, 1956.

(2) Hydrometeorological Report 33 (Figure 2), U.S. Army, Corps of Engineers, 1956.

(3) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's Coefficients (C_p and C_t).

(4) Snyder's Coefficients.

(5) L = Length of longest water course from outlet to basin divide.
L_{ca} = Length of water course from outlet to point opposite the centroid of drainage area.

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  11 JAN 79
**********
    1                A1       SNYDER UNIT HYDROGRAPH,FLOOD ROUTING   DAM OVERTOPPING ANALYSES
    2                A2       PA-647 DAM,WASHINGTON COUNTY,NDI-ID.PA821          PROJECT NO.78-367-07
    3                A3       FOR 30%,40%,50%,60%,70%,80%,90%,AND 100% PMF
    4                B     300        0      10       0       0       0       0       0      -4       0
    5                B1      5
    6                J       1        8       1
    7                J1   0.30     0.40    0.50    0.60    0.70    0.80    0.90    1.00
    8                K       0        1                                       1
    9                K1       CALCULATION OF INFLOW HYDROGRAPH TO PA-647 DAM,NDI-ID PA821
   10                Q       1        1    22.4            22.4                                   1
   11                P              24.3      95     114     124     134
   12                T                                                      1.0     .05            0.009
   13                W     6.3     0.57
   14                X    -1.0    -0.05     2.0
   15                K       1        2                                       1
   16                K1       ROUTING FLOW THROUGH PA-647 DAM,NDI-ID.PA821
   17                Y                                       1       1
   18                Y1      1                                              279.0
   19                $S  279.0   1089.0  3575.0  4990.0  7690.0
   20                $E  876.0    894.0   920.0   930.0   946.0
   21                $$  920.0    200.0     3.1     1.5
   22                $D  937.6      5.1     1.5   500.0
   23                K      99
```

COMPUTER INPUT OVERTOPPING ANALYSIS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS							
				RATIO 1 .30	RATIO 2 .40	RATIO 3 .50	RATIO 4 .60	RATIO 5 .70	RATIO 6 .80	RATIO 7 .90	RATIO 8 1.00
HYDROGRAPH AT	1	22.40	1	7599.	10135.	12666.	15199.	17732.	20265.	22798.	25331.
	(	58.02)	(	215.19)(	286.92)(	358.65)(	430.38)(	502.12)(	573.85)(	645.58)(	717.31)(
ROUTED TO	2	22.40	1	6273.	9458.	12284.	14916.	17479.	19984.	22459.	24971.
	(	58.02)	(	177.63)(	267.82)(	347.84)(	422.37)(	494.95)(	565.90)(	635.97)(	707.11)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	876.00	920.00	937.60
STORAGE	279.	3575.	6272.
OUTFLOW	0.	0.	45778.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.30	924.68	0.00	4237.	6273.	0.00	47.83	0.00
.40	926.15	0.00	4445.	9458.	0.00	46.83	0.00
.50	927.32	0.00	4611.	12294.	0.00	46.33	0.00
.60	928.33	0.00	4754.	14916.	0.00	46.17	0.00
.70	929.26	0.00	4886.	17479.	0.00	46.00	0.00
.80	930.13	0.00	5012.	19984.	0.00	46.00	0.00
.90	930.95	0.00	5150.	22459.	0.00	46.00	0.00
1.00	931.75	0.00	5285.	24971.	0.00	46.00	0.00

OVERTOPPING ANALYSIS SUMMARY

APPENDIX E

REGIONAL GEOLOGY

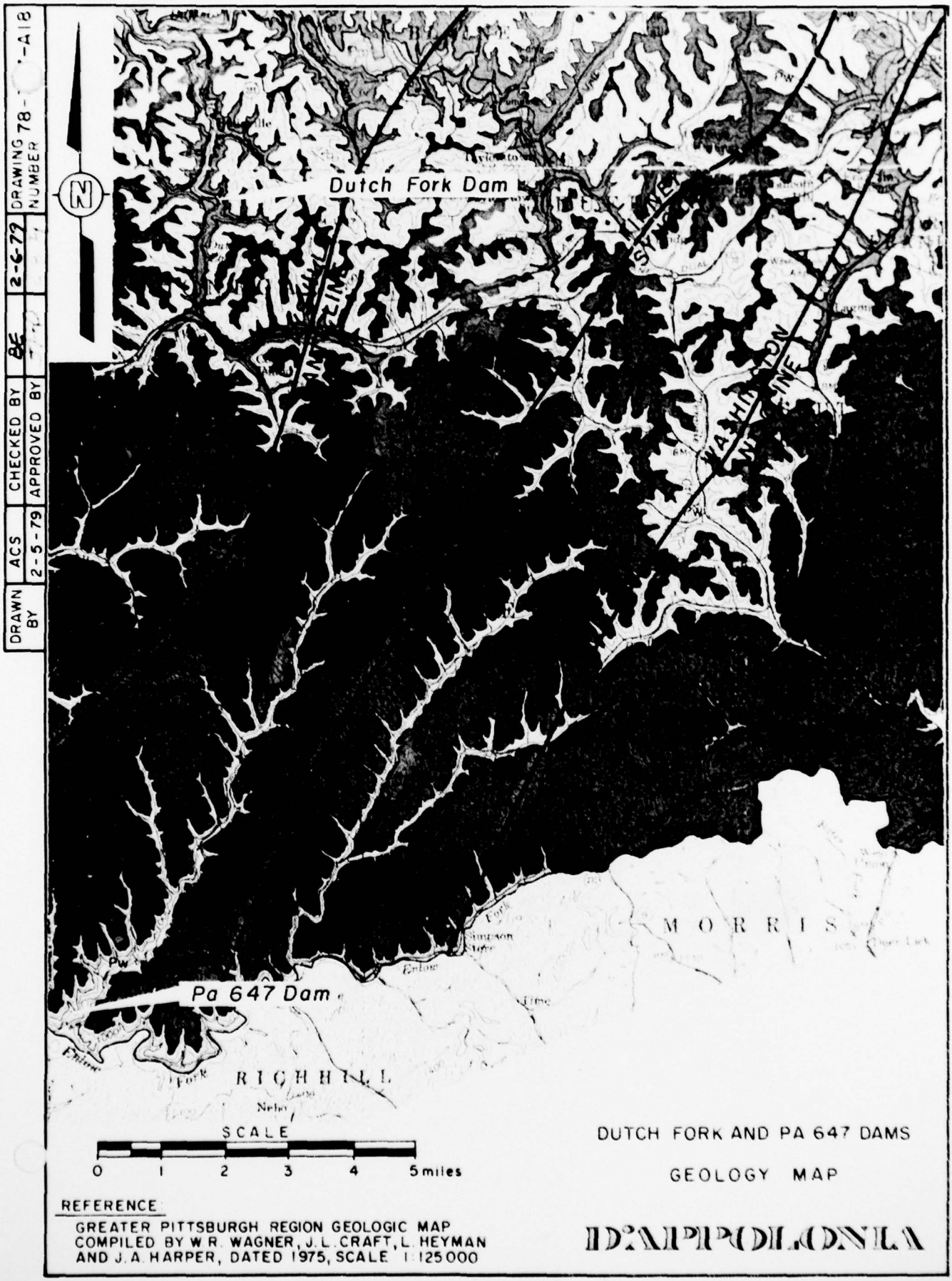
APPENDIX E
REGIONAL GEOLOGY

Pennsylvania Dam 647 is located near the axis of the Finney Syncline, a structure composed of a series of small basins. The dam is located south of one of these basins, with the strata dipping gently north-northeast. The strata are composed of the Washington and Greene formations, both members of the Dunkard Group (Permian Age), and consist of interbedded shale, limestone, sandstone, and coal. The bedding strikes approximately N40W and dips 5 degrees to the east. There are two major joint systems with strikes of N45W and N45E. Other trends include N75E, N15W, and north-south. All of the discontinuities are nearly vertical.

The strata are typical of those found in southwestern Pennsylvania. The shale is gray to green-gray, soft, and frequently calcareous. The limestone is a gray crystalline argillaceous limestone. The sandstone is a gray shaly rock which may be calcareous. There are also numerous coal seams or their equivalent composed of black shale. These strata are interbedded with the shale, the predominant rock type.

There are numerous coal seams in the area, with the Pittsburgh, Waynesburg, and Washington coal seams the most economically mineable seams. The Waynesburg and Washington seams are located near the surface, and there are some "country bank" mines in the Waynesburg seam north of the dam and reservoir. The Pittsburgh seam is approximately 300 feet below the dam.

The soil in the area is mostly residual and may be thick, with weathered rock occurring up to depths of 20 feet or more. The strata in the area are easily weathered and the weathered material is subject to movement on slopes. In the area, 30 to 40 percent of the land is covered by slide deposits, and there are several old slides in the slopes above the dam and reservoir, as indicated on the U.S. Geological Survey Map of Landslides for Washington County, Pennsylvania, dated 1978.



DUTCH FORK AND PA 647 DAMS

GEOLOGY MAP

REFERENCE

GREATER PITTSBURGH REGION GEOLOGIC MAP
COMPILED BY W.R. WAGNER, J.L. CRAFT, L. HEYMAN
AND J.A. HARPER, DATED 1975, SCALE 1:125000

DAMPRODUCTS

DRAWN BY	ACS	CHECKED BY	BE	2-6-79	DRAWING NUMBER 78 17-A22
	2-5-79	APPROVED BY	[illegible]	2-8-79	

GROUP	FORMATION		DESCRIPTION
	Alluvium	Qt	Sand, gravel, clay.
	Terrace deposits		Sand, clay, gravel on terraces above present rivers; includes Carmichaels Formation.
DUNKARD	Greene		Cyclic sequences of sandstone, shale, red beds, thin limestones and coals.
DUNKARD	Washington	Pw	Cyclic sequences of sandstone, shale, limestone, and coal; contains Washington coal bed at base.
DUNKARD	Waynesburg		Cyclic sequences of sandstone, shale, limestone and coal; contains Waynesburg coal bed at base.
MONONGAHELA		Pm	Cyclic sequences of shale, limestone, sandstone and coal; contains Pittsburgh coal bed at base.
P: CONEMAUGH	Casselman	Pcc	Cyclic sequence of sandstone, shale, red beds and thin limestone and coal.
P: CONEMAUGH	Ames		
P: CONEMAUGH	Glenshaw	Pcg	Cyclic sequences of sandstone, shale, red beds and thin limestone and coal; several fossiliferous limestone; Ames limestone bed at top.
ALLEGHENY	Vanport		Cyclic sequences of shale, sandstone, limestone, and coal; contains Brookville coal at base and Upper Freeport coal at top; within group are the commercial Vanport limestone and Kittanning and Clarion coals.
ALLEGHENY		Pa	

GEOLOGY MAP LEGEND

REFERENCE:

GREATER PITTSBURGH REGION GEOLOGIC MAP
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